ORAL ROENTGENOLOGY

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ORAL ANESTHESIA, Local Anesthesia in the Oral Cavity for the Different Branches of Dentistry.

ORAL ABSCESSES, A Pathological Study of Infectious Foci in the Mouth and Their Relation to Somatic Diseases.

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A ROENTGEN STUDY OF THE ANATOMY AND PATHOLOGY OF THE ORAL CAVITY

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WITH THREE HUNDRED AND ELEVEN ILLUSTRATIONS

BOSTON, MASS.
RITTER & COMPANY
1917

TO THE MEMORY OF MY MOTHER

BERTHA THOMA-SCHILL

BORN AND DIED IN BASEL, SWITZERLAND

THIS VOLUME IS DEDICATED

PREFACE

ROENTGENOLOGY has become a most important means of diagnosis and a great aid in the treatment of diseases of the oral cavity.

For many conditions the Roentgenogram is only used to ascertain the exact nature of the lesion which has already been diagnosed by other methods, but for chronic diseases which occur without giving any symptoms, the Roentgen method is sometimes the only way by which the lesion can be discovered. In searching for the cause of nerve irritation or for foci of infection, negative findings are often as valuable as positive ones in establishing the presence of and eliminating oral diseases as causative factors.

No dentist who has the welfare of his patients at heart can practise to-day without the aid of this important method of examination. The research workers and pioneers of the profession have found the Roentgenogram a valuable aid in checking up the results of new treatments in order to prove or disprove the advantage of the new procedure.

A Roentgen machine is a great asset to the office equipment of a dentist, but if he would rather rely on a specialist for taking the Roentgenogram he has the advantage of being able to consult a man who has had wide experience and special training in this branch of dentistry. In many cities Roentgenology has been made use of as a trade, and laboratories have been established by laymen who not only take pictures, but furnish elaborate reports. They are not to blame, however, nor can the law successfully stop them. The fault lies with the men of the profession who patronize them. Such practitioners lower the standard of this important specialty and of the dental profession in general, to say nothing of the danger of exposing patients to ignorant diagnostitians and infections which may be carried from one mouth to another.

The Roentgenologist should have a special knowledge of the anatomy, histology and pathology of the parts he is examining, as well as a familiarity with all the problems of dentistry and the various supplementary

methods of diagnosis. It is only such knowledge which can enable the Roentgenologist to make a correct diagnosis from a Roentgen picture, which does not record disease, but only variations in the radiability of the various organs, structures and tissues.

The author's aim is to base the Roentgenographic study of the mouth upon a broad knowledge of anatomy, histology and pathology and, in the first part, to give the student, as well as the practitioner, a chance to compare photographs showing the outside and inner make-up of the jaws with the Roentgen picture. In the following parts the various diseases affecting the teeth and jaws are taken up according to their pathological classification. Whenever possible, there was a photograph added to show how the tissues were affected by the disease, while a large number of Roentgenograms were put in to illustrate practical cases. With most of the pictures has been given a history of the case, a conclusion from the Roentgen picture and a report of operative findings, the result of the operation having been added sometimes with the intention of not only showing pictures, but of giving the reader a most intimate knowledge of the case. In the last part, the use of Roentgen pictures as an aid in treatment is taken up and the illustrations have been chosen with the idea of making the chapter a practical help.

The majority of the photographs and Roentgen pictures are original, the cases either having been referred for Roentgen diagnosis or surgical treatment to the author, who wishes, however, to acknowledge here his gratitude to all of his professional friends who have contributed indirectly to this book by referring to him the patients whose Roentgenograms have been used. A number of special contributions have been gratefully received from Dr. A. W. George, Dr. Ralph Leonard, Dr. L. B. Morison and others, to whom the author particularly extends his thanks for their interest in this volume. All special contributions have been acknowledged under the description of the case.

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June 20, 1917.

CONTENTS

INTRODUCTION

IT is not in the scope of this book to describe Roentgenographic apparatus and technique. These details can be acquired from books written on this subject and, for dentists, there is none better than Raper's "Elementary and Dental Radiography." To obtain clinical information from Roentgenograms and to teach the general practitioner, as well as the student, to depend on his own eyes in interpreting the conditions presented to him, it is important to understand first the basic principles involved in applying the Roentgen ray and to have an exact knowledge of what is meant by the special terms used in this science.

Roentgen Nomenclature. There are a great many Roentgen terms in use and there has, so far, been no standardization in dental literature. In this book, the terms employed are those which have been adopted by the American Roentgen Ray Society, October 1, 1913 and accepted by the Journal of the American Medical Association. The Committee on Nomenclature of the American Institute of Dental Teachers also recommends their use.

ROENTGEN RAY. A ray discovered and described by Wilhelm Conrad Roentgen.

ROENTGENOLOGY. The study and practice of the Roentgen ray, as applied to medical science.

ROENTGENOLOGIST. One skilled in Roentgenology.

ROENTGENOGRAM. A shadow picture produced by the Roentgen ray on a sensitive plate or film.

ROENTGENOGRAPH. (Verb) To make a Roentgenogram.

ROENTGENOGRAPHY. The art of making Roentgenograms.

ROENTGEN DIAGNOSIS. A diagnosis made by means of Roentgenograms.

In addition to these terms the following words have been made use of, the three latter having been supplied by Dr. Ottolengui to meet a long felt need adequately to express certain properties:

RADIABILITY. The property of an object to transmit the Roentgen ray.

RADIOPARENT. } Offering no barrier to the Roentgen ray.
RADIOPARENCY. }

RADIOLUCENT. } Offering slight resistance to the Roentgen ray.
RADIOLUCENCY. }

RADIOPAQUE. } Impervious to the Roentgen ray.[1]
RADIOPACITY. }

Interpretation of Roentgenograms. The Roentgen picture records upon a photographic plate or film the various obstructions of the tissues placed in the path of the ray. The nearer the object is brought to the plate, the more precise and less distorted is the picture. The radiability of different objects varies. The soft tissues are very radiolucent, transmitting the ray easily, but not as well as air, while bone, which contains little organic matter, is radiopaque. A tooth is more radiopaque and enamel still more so, on account of its high percentage of calcium salts. Cavities in the bone, such as the maxillary sinuses, are highly radiolucent when in healthy condition and produce a dark image on the plate.

The first three illustrations depict such changes in the radiability. Figure 1 shows part of the mandible. Note that the second molar is a perfectly normal tooth. If part of the tooth substance is lost the radiability is increased, as happens when decay causes a cavity. This is illustrated in Figure 2, showing a buccal cavity in the second molar. Metal placed in this cavity obstructs the rays and its radiopaque property leaves the surface of the film light (see Figure 3).

Pathological Conditions. The degree to which pathologic conditions can be recognized in the Roentgenogram depends upon what can be demonstrated upon the Roentgen plate. It gives us a picture in the anatomic pathological sense, since the finer pathologic conditions shown by a microscope will not produce an effect which can be differentiated by the eye. When studying pathological conditions by means of the Roentgen ray, it should also be kept in mind that a Roentgenogram does not show disease, but only the comparative value of the radiability of the tissues.

The etiological factor, the duration of the disease and the fact whether a lesion is acute or chronic cannot be found out by the Roentgen method. We may find radiolucent areas which we associate from experience with necrosis, but the Roentgenogram gives no information as to whether they

[1] Editorial: *Items of Interest*, Feb. 1917, Page 141.

are syphilitic or tubercular, of acute type or long standing. Disease may affect the radiability in various ways. Fracture of a bone will leave a radiopaque area between the fragments. Accumulation of pus in the cancellous part of the jaws without involvment of the bone will decrease the radiability; if it occurs between the bone and the periosteum it may not make enough difference to leave a record, while the destruction of bone, due to inflammatory processes, will greatly increase the radiability and show as a dark area on the plate.

When examining Roentgenograms one should always compare the part under observation with the corresponding part of the individual who is being examined. This is often of great value, especially if there is only a slight deviation from the normal, as, for instance, in the case of the sinuses of the face. It is the comparative value of the radiability of the normal sinus on one side and the suspected one on the other side by which the Roentgen diagnosis is made.

The location of the suspected trouble is first ascertained and then one should determine the exact position of the object and its relation to the surrounding parts. This is done by means of two or more Roentgenograms taken from various angles, or by means of a stereoscopic Roentgen picture.

The size and shape of the part should be noticed, in order to recognize any departure from the normal, such as increased size or irregularities. The age of the patient ought to be considered also and the condition compared with that of the normal part of the same age. It is normal to find an unerupted cuspid in a child ten years old, but at the age of forty, it would be an abnormal condition.

Misconceptions may arise from a distortion of the angle at which the picture is taken, from faulty technique, the interposing of other parts, or lack of knowledge and training in anatomy and pathology; also from incorrect interpretation of what the eye is actually seeing. Part of the maxillary sinus is frequently superimposed at the ends of the roots of the upper molars and bicuspids and is liable to be interpreted as a large pathological cavity. The mental foramen is often projected to one side and, especially on extraoral Roentgen pictures, may be seen as a dark area at or near the apex of the lower second bicuspid. If the tooth is devitalized, several Roentgenograms are needed to make sure of the finding. However, one can nearly always trace the mandibular canal

and if it leads to the dark area we have to do with the foramen. In pictures of the upper incisors the incisive foramen also causes confusion at times. While it is generally a well-defined triangular area in the median line and above the incisors, it may occasionally be projected towards one side and if it happens to be superimposed over the apex of one of the centrals, it might be misinterpreted. When taking intraoral pictures of the last molars in the upper jaw we often include the projection of the zygomatic process of the maxilla, which at this angle decreases the radiability and part of the coronoid process of the ramus is frequently interposed when the picture is taken from a more posterior angle. This, at times, gives the appearance of a decayed root (see Figures 4 and 5). A proper allowance must also be made for distortions of various parts, due to bending of the film. Many incorrect readings can be avoided by taking two or three exposures from varying angles and it is also a great advantage to develop the pictures while the patient is waiting, so that in case of doubt the pictures may be repeated.

Extraoral Roentgen Method. The large extraoral plates are very useful for giving an entire survey of the region involved. Without them malposed teeth, large cysts, affections of the ramus and diseases of the maxillary sinuses might often escape notice, as such conditions cannot be included in the small films which are used inside the mouth.

Intraoral Roentgen Method. The intraoral method, however, is the one usually chosen to diagnose the conditions closely associated with the alveolar process or the teeth when in normal position. Such pictures are always much more distinct and show detail with more accuracy than the extraoral plates because they can be brought closer to the object. There is also less danger of distortion and superimposition of shadows. However, if the intraoral picture leaves any doubt, or shows a condition only in part, one should make it a rule to take an extraoral picture at once.

Roentgen Negatives and Roentgen Prints. The Roentgen negative is the picture that is produced either on a sensitive plate or film. All radiolucent parts of the object appear as dark areas while radioparent parts show light. Of these Roentgenograms prints may be made by any of the methods used in photography. These Roentgen prints show a reversed picture, radiolucent parts appear light while the radiopaque objects show in dark shades.

All Roentgenologists use the negative Roentgen picture to make their

diagnosis from. If duplicates are wanted to keep as records, two plates or two films, one placed over the other, are used and exposed simultaneously. The small intraoral films are put up in pairs by the manufacturers so that one can be kept as record while the other may be sent with the Roentgen diagnosis.

For reproducing Roentgenograms for publication or lantern slides, prints have been used by most of the authors in the past. This, however, tends to confuse men who are not very familiar with the reading of Roentgenograms. It further has the disadvantage that it renders more difficult comparison of the author's Roentgen results with one's own. For teaching purposes, however, and as illustrations in textbooks, Roentgen prints are as good as worthless because they fall short of their purpose. The principle aim of the illustrations in a textbook of Roentgenology should be to familiarize the student with the appearance of the various tissues in health and disease as pictured in a Roentgenogram not as printed occasionally in a magazine, but as used daily for clinical purposes.

Roentgenogram of Normal Teeth

Figure 1.

The second molar, like the others, is a perfectly healthy tooth. The crown, being covered by enamel, is radiopaque and shows light in the picture.

Roentgenogram Showing a Radiolucent Area

Figure 2.

A cavity on the buccal side of the second molar increases the radiability and shows darker than the rest of the crown.

Roentgenogram Showing a Radiopaque Area

Figure 3.

A metal filling placed in the cavity decreases the radiability and, therefore, shows as a light area in the Roentgen negative.

FIGURE 1.

FIGURE 2.

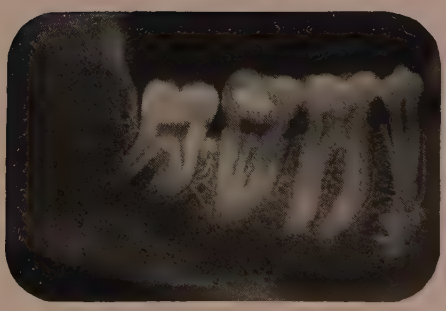


FIGURE 3.

Roentgenology of Conditions Liable to Misinterpretation

Figure 4.

Patient: Mr. W.

Roentgen Examination: Shows part of the coronoid process of the ramus in the lower left-hand corner.

Figure 5.

Patient: Mrs. W.

Roentgen Examination: Part of the coronoid process is seen at the side of the picture and might be taken for the roots of a wisdom tooth with decayed crown.

Figure 6.

Patient: Miss H.

Roentgen Examination: Shows large radiolucent area in lower jaw around the apex of the first bicuspid. The second bicuspid is a devitalized tooth with root canal filling and shows a slight radiolucent area immediately beneath its root. A little further down is a well defined radiolucent area lying in the path of the mandibular canal. It is a picture of the mental foramen.

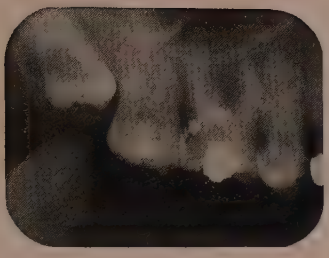


FIGURE 4.

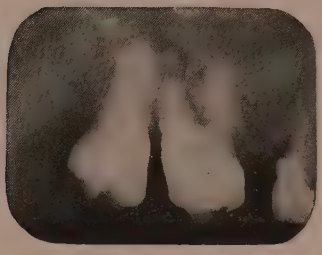


FIGURE 5.

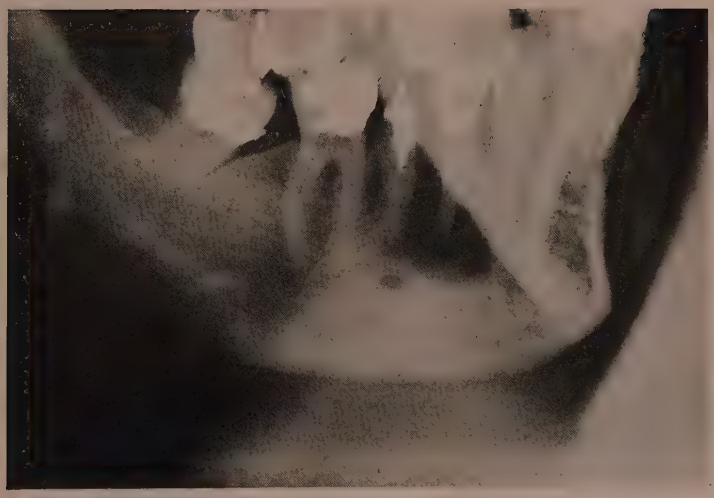


FIGURE 6.

PART I

ROENTGENOGRAPHIC STUDY OF THE NORMAL ORAL TISSUES

THE Roentgenologist should have a thorough and detailed knowledge of the conditions which represent living normal anatomy at different periods of its development and should also be familiar with the pathologic conditions representing the various diseases as they appear post mortem. The appearance of Roentgenograms of the normal anatomical conditions of the oral cavity should, therefore, be studied first and in Roentgenology it is not only necessary to be familiar with the external anatomy of the part to be examined, but also with the interior structure, because the Roentgen picture shows not only the outline, shape and prominences of the object externally, but gives us also detail of its internal or general structure.

When studying Roentgenograms, it should be borne in mind that the various tissues change during life and that what would be normal for one period of development would be abnormal for another. Therefore, a knowledge of the different stages of development of the teeth and jaws should first be obtained.

1. The Development of the Teeth

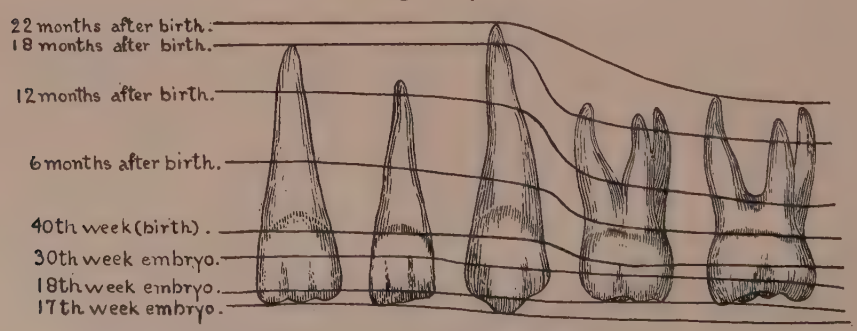
Preparation for the development of the teeth takes place as early as the middle of the second month of fetal life and prior to the formation of the bony structures which finally surround and give support to them. Following the line of the future alveolar ridge, the tooth band is formed in each jaw. It is continuous from one end to the other. Soon each band throws out ten little buds, which develop into the enamel organs of the twenty deciduous teeth. While the enamel organ is developing, a change takes place in the connective tissue of the primitive jaw; the cells crowd into its concavity and become more highly specialized, forming the dentine organ. The two are surrounded by the dental follicle, which is formed from the base of the dentine organ. These three parts make up the tooth germ and develop highly specialized cells, which produce the

various parts of a tooth. The enamel organ gives formation to the ameloblasts which form the enamel. The dentine organ deposits dentine at its periphery by means of odontoblasts, while the inner part remains as the dental pulp. The inner part of the dental follicle, at an advanced period, assists in the formation of the cementum by means of cementoblasts, while its remaining outer part finally evolves into the alveolo-dental membrane. The permanent teeth are formed in similar manner. Before the epithelial cord is broken, a bud is given off from the neck of the enamel organ, which develops into the enamel organ of the corresponding permanent tooth. From the enamel organs of the incisors and cuspids arise the buds of the permanent incisors and cuspids, and from the enamel organs of the temporary molars develop the buds of the bicuspids. The first permanent molar originates from a bud given off from the posterior extremity of the tooth-band, while the buds of the second and third molars emanate from the outer layer of the enamel organ of the first and second molars respectively.

Calcification of the Temporary Teeth. Calcification starts about the fourth month of fetal life. The future cutting edges of the incisors and the cusps of the back teeth are the first affected. At the time of birth the crowns of the incisors are completely calcified and those of the molars almost so. Calcification of the temporary teeth is completed at the end of the second year when the roots are fully formed and the apical foramina established. The diagram shown in Figure 7 gives an idea of how far the temporary teeth have become calcified at a given age.

Eruption of the Temporary Teeth. Bone formation of the jaws starts about the middle of the second month of fetal life. Several centers

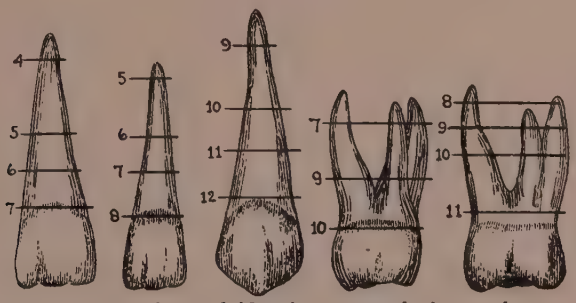
Figure 7.



Progress of Calcification of the Temporary Teeth at different Periods.

of ossification appear and these soon unite so that the contour of the primitive jaw is established at the end of the second fetal month. The bone, first forming an open gutter beneath the tooth follicles, soon surrounds their lateral walls and finally encloses each follicle in a separate compartment, the sides arching over and almost completely enclosing the developing teeth. This condition is reached between the seventh and eighth months after birth. Almost simultaneously absorption of the bone begins, caused by the advancement of the erupting teeth. Most of the temporary teeth erupt soon after their crowns have been completed. The region where the tooth is to erupt is marked by a whitish appearance, the mucous membrane is then penetrated and the cutting edge of the tooth appears in the mouth. As the crown advances, the root becomes more and more calcified and in the majority of instances by the time the crowns are fully erupted the roots are also completely formed. At the same time rebuilding of the bone takes place and it rapidly fills in about the roots of the teeth. When the tooth has assumed its final position it is firmly supported by the newly-formed alveolar process. The teeth usually erupt by pairs. The central incisors come first, then the laterals and then the molars. The cuspids usually appear next and finally the second molars take their places. Generally at the end of the second year all the temporary teeth are erupted.

Figure 8.

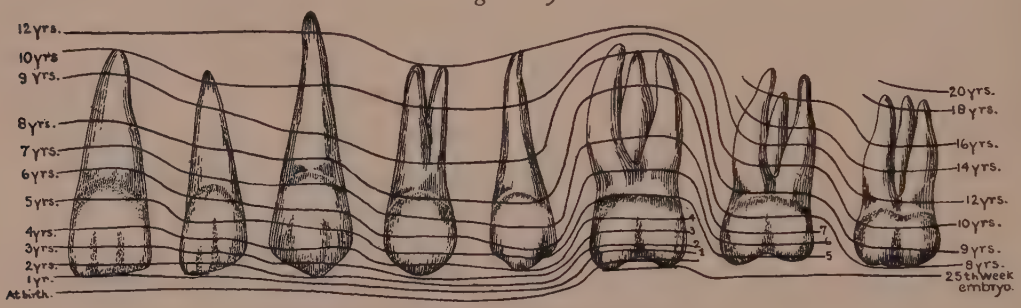


Progress of Decalcification at yearly intervals.

Decalcification of the Temporary Teeth. The temporary teeth remain intact only a short time and the process of decalcification, beginning about the fourth year at the apices of the central incisors, follows the order of their eruption. The process is completed in about three years, when the remainder of the tooth is cast off or shed. Figure 8 gives an idea of the relation between the age of the child and the process of decalcification.

Calcification of the Permanent Teeth. Of the permanent teeth, it is the six-year molar in which calcification first begins, the cusps having started to calcify at the time of birth. The other teeth follow correspondingly, as illustrated in Figure 9. All the teeth are fully calcified between the eighteenth and twentieth years.

Figure 9.



Progress of Calcification of the Permanent Teeth.

Eruption of the Permanent Teeth. The formation of the permanent teeth occurs above and below the temporary ones and on the lingual side. They take up part of the space formerly occupied by the roots of the temporary teeth, but the large crowns, having hardly enough room in the child's jaws, are pushed way down to the inferior border of the mandible, or high up in the maxilla. This is especially true of the cuspids, the roots of which are almost completely calcified at the time of the tooth's eruption. Gradually the crowns of the permanent teeth force their way to the surface. The first permanent molars erupt about the sixth year, behind the second temporary molars. Then the crowns of the temporary incisors are cast off, being succeeded by the permanent ones. The bicuspids take the place of the temporary molars, which are lost between the tenth and eleventh years. At about the age of twelve, the second molars erupt. The cuspids replace the temporary cuspids between the twelfth and thirteenth years and in the fifteenth year we find twenty-eight fully erupted teeth. Normally the third molars erupt between the eighteenth and twentieth years, but may be retained, according to the accommodations afforded by the growth of the jaws. They are fully calcified before they make their appearance in the mouth. At the age of twenty, therefore, we should find in a normal case all the thirty-two teeth entirely erupted and the roots fully formed; that is, dentition should be completed.

Chronology of Human Dentition. The approximate time of the beginning and completion of calcification, eruption, decalcification and loss of the teeth is given in the following table. Variations from these dates are, however, very common. As it is often of greatest importance to know the condition exactly in order to decide on the advisability of extracting or retaining a temporary tooth, to determine whether the root-canals are completed, or to discover whether the apical foramen is widely open or closed, it is wise to diagnose the case by means of a Roentgenogram, which discloses the exact condition.

	Tooth	Time Calcification Begins	Time Calcification Completed	Time of Eruption	Time Decalcification Begins	Time Tooth Shed
Temporary Teeth	Central incisor	4th fetal month	17th-18th post-natal month	6th–8th post-natal month	4th year	7th year
	Lateral incisors	4th fetal month	14th–16th post-natal month	1st–9th post-natal month	5th year	8th year
	Cuspids	5th fetal month	24th post-natal month	17th–18th post-natal month	9th year	12th year
	1st molars	5th fetal month	18th–20th post-natal month	14th–15th post-natal month	6th–7th year	10th year
	2d molars	5th–6th fetal month	20th–22nd post-natal month	18th–24th post-natal month	7th–8th year	11th–12th year
Permanent Teeth	Tooth					
	Central incisor	1st year	10th-11th year	7th–8th year		
	Lateral incisor	1st year	10th–11th year	7th–8th year		
	Cuspids	3d year	12th–13th year	12th–13th year		
	1st bicuspid	4th year	11th–12th year	10th–11th year		
	2d bicuspid	5th year	11th–12th year	11th–12th year		
	1st molar	8th fetal month	9th–16th year	6th–7th year		
	2d molar	5th year	17th–18th year	12th–14th year		
	3d molar	9th year	18th–20th year	17th–20th year		

The mandibular teeth precede those of the maxilla by short intervals.

2. The Normal Adult Jaw and Teeth

The two jaws, the maxilla and the mandible, are very dissimilar in their make-up. Not only does this apply to their shape and appearance, the former being irregular and the latter resembling, more or less, a flat bone, but especially do they vary in structure. They are both covered by periosteum, through which the bone receives part of its nourishment. In a Roentgen picture the periosteum is not visible if the bone is normal,

but becomes apparent when there is an exudate beneath it or when it is inflamed or thickened.

The Maxilla. The maxillary bone encloses a large cavity, the maxillary sinus. Its walls, therefore, are very thin. The teeth are contained in the alveolar process, which is made up of an outer and an inner plate of hard, solid bone called cortex. The outer plate is very thin and frail, especially over the apices of the central incisors, cuspids and bicuspids, so that abcesses occurring in these regions readily find an outlet to the surface and cause a minimum amount of bone destruction. Further back the bone becomes thicker and we usually find it massive over the second molar, where the zygomatic process has its origin. There are as many alveolar sockets as there are roots of teeth. These sockets in their normal condition are covered with a layer of dense bone, which is called the stratum durum and is shown in Figures 18 and 27. In a Roentgenogram this dense, hard bone, which is very radiopaque, shows as a light line. Posterior to the teeth we find a rounded eminence, the maxillary tuberosity (see Figure 20). The inner part of the bone is cancellous and consists of medullary spaces surrounded by trabeculae of bone, which form a reticular structure. These trabeculae, being radiopaque, show in the Roentgenogram as light lines forming a lattice-work which encloses darker areas, representing the enclosed radiolucent spaces (see Figure 19).

The Maxillary Sinuses. These sinuses vary considerably in size, shape and capacity. Usually, in order to get an idea of their form, a frontal and a lateral Roentgenogram are necessary. The posterior and anterior walls are crossed by the alveolar nerves and vessels, which are usually contained in bony canals, into which they enter by special foramina (see Figure 21). The bicuspids and molars are in close relation to the antra and frequently the apices extend through their floors and cause small prominences covered by a thin layer of bone and mucous membrane (see Figures 18 and 19).

When healthy, the maxillary sinuses are extremely radiolucent and, therefore, show dark in the negative. It is important to always Roentgenograph both antra, so that they may be compared (see Figure 22).

The Mandible. The mandible consists of a body and two rami. The body which supports the teeth is the part with which we are particularly concerned, but the ramus is also important as it is not infrequently affected by disease. The mandible is made up of an extremely thick,

strong cortex, consisting of an inner and an outer plate, both of which are much stronger than those of the maxilla (see Figure 26). In the molar region the bone is reinforced still more by the massive internal and external oblique lines. The construction of the cancellous part is like that of the upper jaw and is shown in Figures 24 and 27. The ramus of the mandible is similar in make-up to the body. Its size and massiveness vary according to the individual.

The Mandibular Joint. The joint of the lower jaw is made up of the condyloid process of the mandible, the glenoid fossa and the joint disc placed between the two articulating surfaces. It is sometimes extremely difficult to get a satisfactory Roentgen picture of this joint, but when obtained it is of great help in cases of fracture of the condyle or dislocations (see Figure 28).

The Mandibular Canal. This canal starts from the mandibular foramen and can easily be traced in a good Roentgenogram. The knowledge of its relation to the teeth is often of greatest importance in avoiding injury of the inferior alveolar nerve and artery. It passes forward immediately beneath the alveolar sockets in a horizontal direction until it finds an exit at the mental foramen. Here the main canal divides into a number of smaller ones, which pass forward to the sockets of the cuspids and incisors. The mental foramen lies below and between the first and second biscuspids, usually nearer the second one. The foramen, being a space and, therefore, very radiolucent, shows as a dark area especially in an extra-oral Roentgenogram and should not be mistaken for an abscess area.

The Normal Relation of the Teeth to the Jaws. The jaw bones, the alveolar processes and the alveolar sockets have already been described and it has been pointed out that the latter are lined by a cortical layer of bone, the stratum durum, which shows as a light line in the Roentgen picture. Between this and the tooth is the periodontal membrane, by means of which the tooth is attached to the socket. This, being connective tissue, is of high radiolucency and therefore shows as a dark line surrounding the entire root of the tooth.

The Teeth in Youth and Old Age. The size of the pulp cavity depends upon the age of the tooth. At the time of eruption, the diameter is about equal to one-half of the crown, the root-canal being widest at the apical part, where it presents a funnel-shaped opening (see Figure 30). After the apical part is completely formed there is still a good-sized root canal

(see Figure 31), but all through life a gradual reduction in size goes on, due to the deposit of new dentine by the odontoblasts. This process is hastened by certain conditions such as decay and the presence of large metal fillings, probably as a protective measure. In old age, and sometimes earlier, on account of conditions such as those just mentioned, we often find the canals of minute size and even obliterated entirely (see Figure 32).

Roentgenology of Tooth Development

Figure 10.

Specimen: Fetus, six months old.

Roentgen Examination: Note Meckel's cartilage, bone formation of the jaws and small tooth plates indicating the beginning of calcification of the temporary teeth.

FIGURE 10.

Roentgenology of Tooth Development

Figure 11.

Patient: A. H., girl three years old.

Roentgen Examination: All the temporary teeth have erupted. The calcification of the permanent cuspid and first molar has reached about two-thirds of the crowns. The tip of the first bicuspid is seen between the roots of the first temporary molar in the lower jaw.

Figure 12.

Patient: H. S., girl four years old.

Roentgen Examination: Here we find further progress in tooth development. The roots of the first temporary molar have been considerably absorbed. Calcification of the cuspid, first bicuspid and first permanent molar has further advanced.

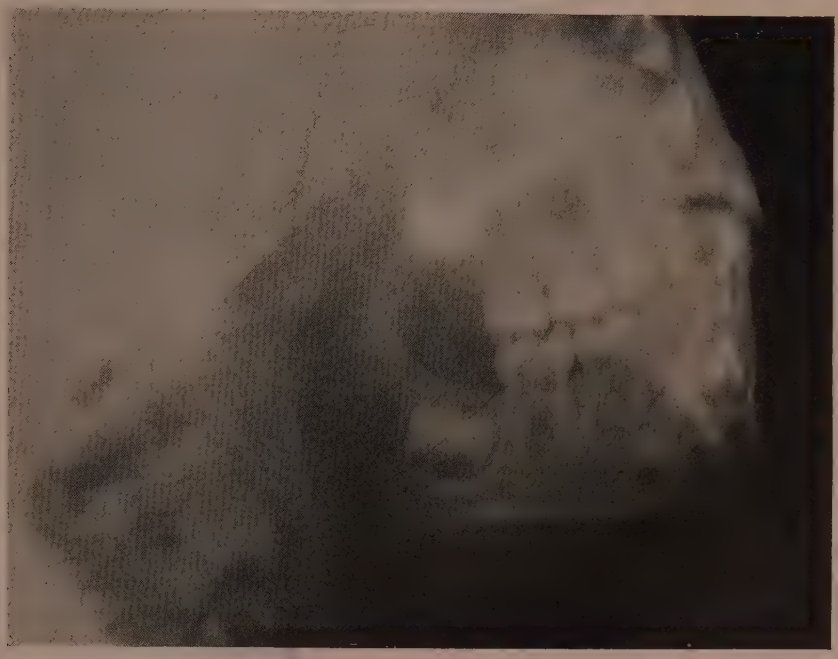


FIGURE 11.

FIGURE 12.

Roentgenology of Tooth Development

Figure 13.

Patient: E. L., boy five years old.

Roentgen Examination: Shows the first permanent molars partly erupted, but not yet in occlusion. The roots are not entirely formed. The crowns of both bicuspids are found between the roots of the temporary molars, which have become partly decalcified. The second molars have their crowns half formed.

Figure 14.

Patient: W. C., girl seven years and eight months old.

Roentgen Examination: The development of the permanent teeth has progressed still further and the roots of the temporary molars are two-thirds absorbed. The first permanent molar is in occlusion and its roots are almost finished.

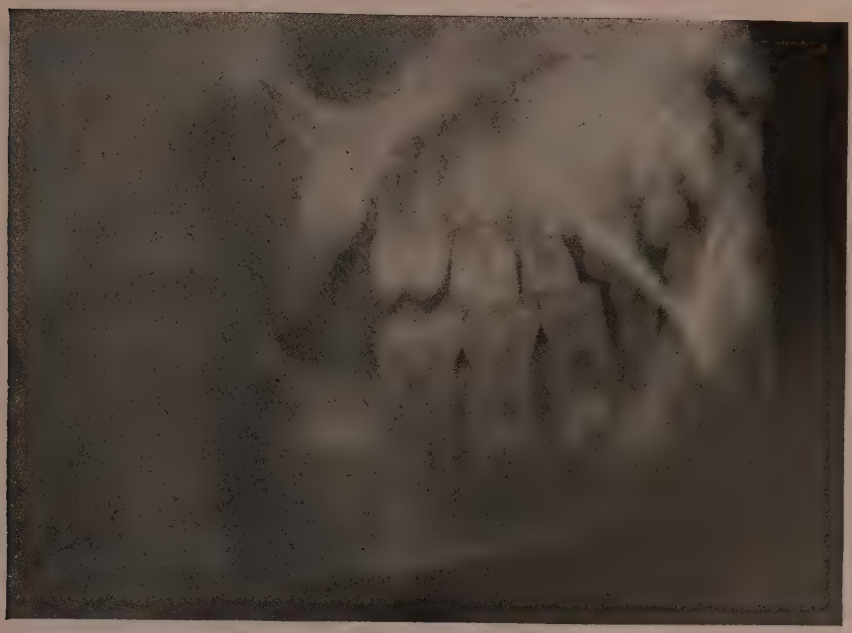


FIGURE 13.

FIGURE 14.

Roentgenology of Tooth Development

Figure 15.

Patient: F. G, girl ten years old.

Roentgen Examination: The first temporary molar has been shed in the lower jaw and the first bicuspid is about to erupt. The roots of the second temporary molar are almost entirely absorbed. The roots of the cuspid, first and second bicuspids and second permanent molar are still only partly formed, while the roots of the first permanent molar are completed. Note that the third molars have started to become calcified.

Figure 16.

Patient: G. S., girl twelve years and eight months old.

Roentgen Examination: All the temporary teeth have been shed and the permanent ones have taken their places. The second permanent molars are just erupting. In the upper jaw we can see the formation of the third molar, but in the lower jaw there is no sign of it.

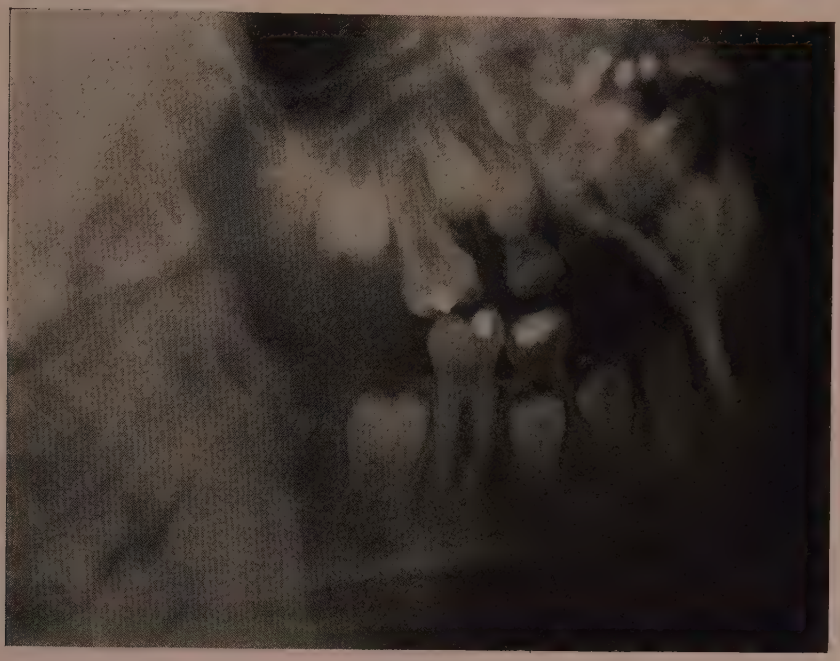


FIGURE 15.

FIGURE 16.

Roentgenology of the Maxilla

Figure 17.

Specimen: Dry skull.

Photograph: Shows the outer aspect of the bone.

Figure 18.

Specimen: Dry skull with outer cortical plate removed and antrum exposed.

Photograph: Shows inner structure of bone and relation of the teeth to the maxillary sinus. Note the stratum durum surrounding the roots.

Figure 19.

Specimen: Dry skull shown in Figures 17 and 18.

Roentgen Examination: Shows the make-up of the inner part of the bone and the relation of the teeth to the maxillary sinus.

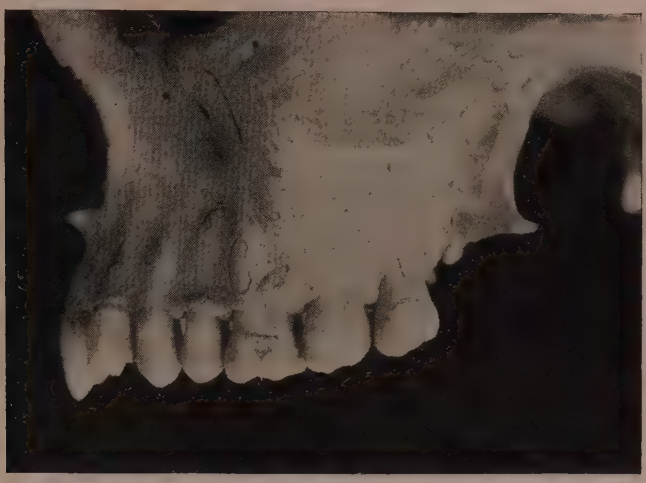


FIGURE 17.

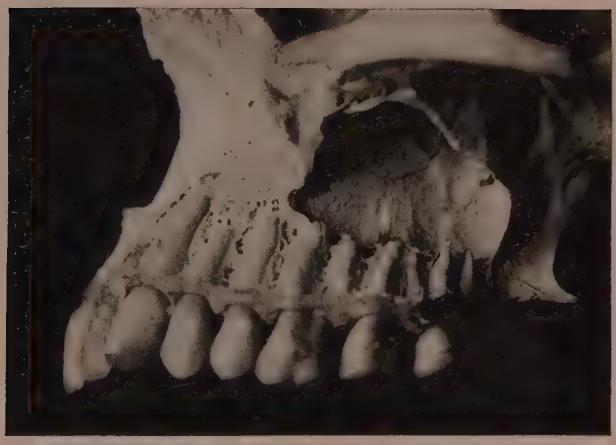


FIGURE 18.

FIGURE 19.

Roentgenology of the Maxillary Sinuses

Figure 20.

Patient: Mrs. L.

Roentgen Examination: Shows the maxillary tuberosity posterior to the third molar. Note its cancellous structure.

Figure 21.

Specimen: Frontal section through the human head.

Roentgen Examination: Shows the outline of the maxillary sinuses and the small canals which contain the alveolar vessels and nerves.

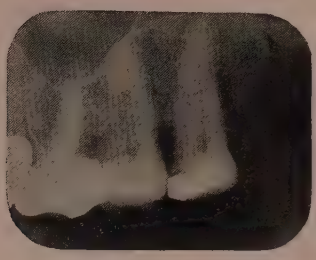


FIGURE 20.

FIGURE 21.

Roentgenology of the Maxillary Sinuses

Figure 22.

Patient: Mr. W. V.

Roentgen Examination: Shows both of the maxillary sinuses, as well as the ethmoidal and frontal sinuses in normal condition.

FIGURE 22.

Roentgenology of the Mandible

Figure 23.

Specimen: From dry skull.

Photograph: Shows outer aspect of bone.

Figure 24.

Specimen: From dry skull, with cortical plate of mandible removed.

Photograph: Shows inner structure of bone. The stratum durum lining the alveolar sockets is especially well shown on the two biscupids. The mandibular canal is partly exposed.

Figure 25.

Specimen: From dry skull shown in Figures 23 and 24.

Roentgen Examination: Shows also the inner make-up of the bone. The stratum durum is seen as a white line and is well shown between the bicuspid and molar. Note the relation of the third molar to the mandibular canal.

FIGURE 23.

FIGURE 24.

FIGURE 25.

Roentgenology of the Mandible

Figure 26.

Specimens: Cross sections of mandible.

Photograph: Shows on left a cross section through bicuspid region. Note the thick cortical bone and cancellous inner part; also the mandibular canal and mental foramen. On the right a cross section of the front of the mandible is shown.

Figure 27.

Specimen: From dry skull with teeth extracted.

Photograph: Shows the make-up of the bone. Note the thick cortical layer at lower border and thinner cortical layer at alveolar margin. The sockets are also lined by cortical bone, the stratum durum.

FIGURE 26.

FIGURE 27.

Roentgenology of the Mandible

Figure 28.

Patient: Mrs. N.

Roentgen Examination: Shows normal mandibular joint, coronoid process and mandibular notch.

Figure 29.

Specimen: From dry skull.

Roentgen Examination: Shows mandibular canal and distribution to the teeth.

FIGURE 28.

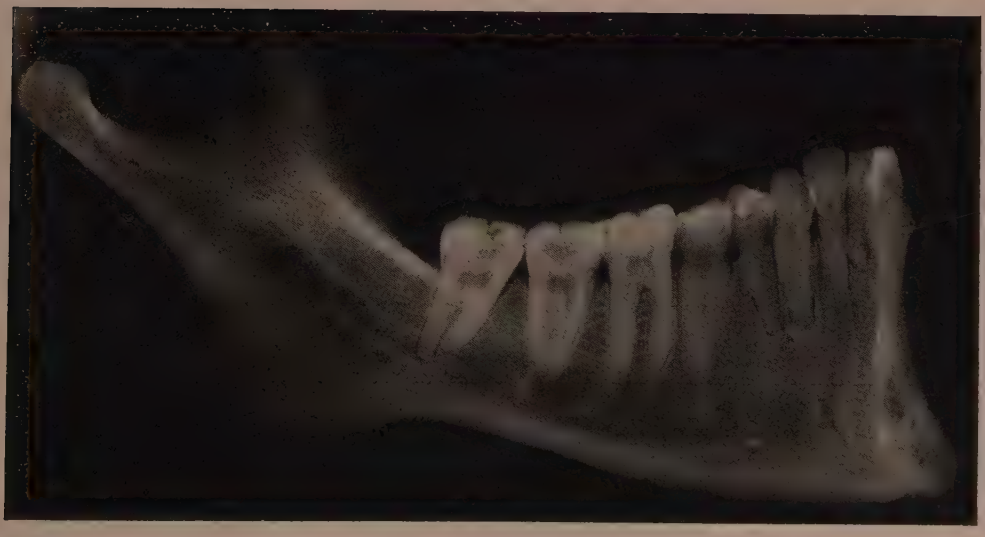


FIGURE 29.

Roentgenology of Normal Teeth

Figure 30.

Patient: Miss J., age 11.

Roentgen Examination: Shows the roots of the first molar finished, roots of the second bicuspid and second molar not yet completed and the foramen wide open. Note size of the pulp canals.

Figure 31.

Patient: Miss G., age 24.

Roentgen Examination: Shows teeth with normal sized pulp canals.

Figure 32.

Patient: Mrs. B., age 48.

Roentgen Examination: Shows pulp chambers very much smaller and root canals decreased in size.

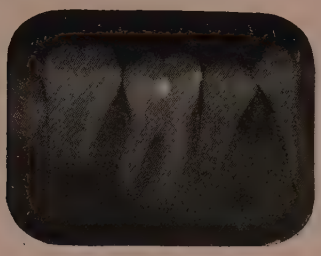


FIGURE 30.

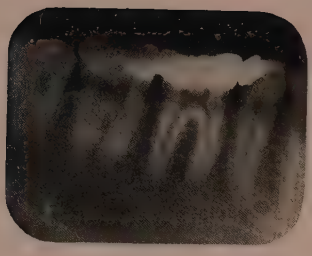


FIGURE 31.

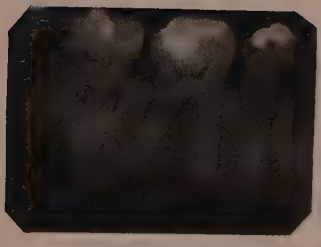


FIGURE 32.

PART II

ROENTGENOGRAPHIC STUDY OF PATHOLOGICAL ORAL CONDITIONS

AFTER having studied the appearance of the normal and healthy oral tissues as they appear in Roentgenograms, we have a standard with which we can compare Roentgenograms of the same parts changed by disease. The Roentgenologist should have an intimate knowledge of the pathologic conditions such as they appear post mortem, as well as under the microscope, although it is only the grosser pathology which can be recognized in the Roentgen picture.

We have come to rely so much on Roentgenograms that we are apt to forget that the Roentgen method does not replace all the other means of diagnosis. It should be used in addition to digital and instrumental examination, occular inspection, transillumination, chemical, thermal and electrical tests.

In examining a Roentgenogram with reference to disease, the interpretation depends a great deal upon a thorough and systematic search for abnormal conditions and upon the anatomical and pathological knowledge and the Roentgenographic experience of the interpreter. The Roentgenologist's judgment is rendered valuable by his ability to associate conditions seen in Roentgen plates with the changes which disease produces in the radiability of the tissues.

1. Irregular Eruption of the Teeth

The use of the Roentgen ray is particularly applicable to the diagnosis of misplaced, unerupted, impacted, supernumerous or missing teeth. The radiability of a tooth is so much less than the surrounding tissue that it stands out in a Roentgenogram in a characteristic manner which makes its size and shape easily recognizable. However, teeth often escape notice, especially if they are far from their normal position. This teaches us to be careful not to make a negative diagnosis from intraoral

films, but to procure a Roentgenogram which shows the entire extent of the maxillary bones.

Misplaced Teeth. Unerupted teeth may be found in any part of the maxilla or the mandible and it is important to include in the Roentgenogram such places as may harbor them; namely, the nasal cavity, the maxillary sinuses, the lower border of the mandible and the entire ramus (see Figures 33 and 190).

Unerupted, Impacted Teeth. Roentgen pictures are not only very useful in determining whether a missing tooth is unerupted and impacted, but are also an aid in studying the relation of such a tooth to the surrounding parts in order to decide on the mode of operation which is required. The Roentgenogram should, therefore, show the entire outline of the tooth and include a fair amount of the surrounding tissues. Unerupted and impacted teeth may be found in various positions and although they often lie dormant for years, they may at any time become associated with neuralgia or dull pains in any part of the head or neck. Their efforts to grow to the surface are usually intermittent, which accounts for the fact that the symptoms are not constant. The pressure which they frequently bring to bear on the tissues towards which they are growing causes at times a physio-pathological absorption of the parts most easily dissolved, so that part of the distal surface of the second molar root may become eaten away from the pressure of the cusp of an unerupted wisdom tooth. Infectious processes are often associated with these conditions and may start from a blind abscess on a neighboring tooth, from a pocket on the gum or through the blood. The process of inflammation sometimes takes a chronic course with intermittent, subacute attacks, or it may be acute from the start. It then involves the surrounding tissues and if it is in the back of the mouth, it may cause inflammation of the fauces and the muscles about the ramus. Pharyngitis and trismus of the muscles of mastication are commonly sequels to an infection from an impacted wisdom tooth.

The lower third molar is the tooth which is most frequently impacted, but the upper third molar is also often in an irregular position. In both jaws the tooth may become impacted beneath the equator of the crown of the second molar, but in the lower jaw there is an additional obstacle, namely, the ascending ramus which is the terminal boundary of the part of the mandible which accommodates the teeth. The cuspid teeth are the

next in the series which are most likely to be impacted, but any tooth, either in the upper or the lower jaw, may become so. It is unusual for temporary teeth to be impacted, but this also happens at times.

Partially Erupted, Impacted Teeth. Difficult eruption and partial impaction occurs quite often, especially in the wisdom teeth, and we are able to discover the presence of a tooth by the part which extends through the gum. However, a Roentgenogram is needed to determine its size and position. Partly erupted, impacted teeth are very liable to become infected, on account of the entrance of the fluid of the mouth into the wound made by the erupting cusp. The infection passes rapidly into the deeper tissues, because the soft tissue does not adhere to the enamel of the crown and leaves a pocket which offers a splendid chance for infection.

RETENTION OF TEMPORARY TEETH, DUE TO ABSENCE OR IMPACTION OF PERMANENT ONES

In certain conditions the temporary teeth remain and are not replaced by permanent ones. This happens when the permanent teeth are congenitally absent and also in cases in which the permanent teeth are prevented from eruption on account of impaction or misplacement. While we occasionally find that such temporary teeth remain for a long time without becoming loose, we more often see in the Roentgen picture that the absorption of the roots proceeds as usual whether the permanent tooth is impacted or missing.

Congenital Absence of Temporary and Permanent Teeth. There are many cases in which the permanent teeth are congenitally absent and usually there is a history that there were no temporary ones either. This is considered by many writers as a sign of a reduction in the human dentition. It is especially the third molars and the lateral incisors which are found to be missing. The importance of Roentgen diagnosis in such cases is apparent, as it prevents the possibility of disturbances being caused under a bridge or a plate by the late eruption of a tooth which was believed to be absent (see Figures 287–291).

Supernumerous Teeth. Man normally has thirty-two teeth. This is a considerable reduction from the mammalian formula, which includes twelve incisors, four cuspids, sixteen bicuspids and sixteen molars in some

species. It is believed that supernumerous teeth are a retrogression or falling back upon the formula of a lower type, but there are also so-called rudimentary peg-shaped teeth which appear occasionally in the dental arch. These are caused by epithelial remnants, parts of the tooth band forming a primitive enamel organ into which a connective tissue papilla grows, so forming, by an analogous process, as in tooth development, more or less well-formed supernumerous teeth.

Roentgenology of Misplaced Teeth

Figures 33 *and* 34.

Patient: Mr. F. S., courtesy of Dr. Gibbons.

History: One year previous to the discovery of the tooth the patient began to suffer periodically from headaches, no local pain whatever being present. He had a bad taste in the mouth every morning and a sinus opening just back of the second molar was found, from which half a dram of pus was discharged in twenty-four hours.

Roentgen Examination: Figure 23 shows side view with probe inserted into the sinus.

Roentgen Examination: Figure 34 shows front view of same.

FIGURE 33.

FIGURE 34.

Roentgenology of Unerupted and Impacted Teeth

Figure 35.

Specimen: Shows partly erupted, impacted lower third molar.

Figure 36.

Roentgenogram: Shows similar condition.

Figure 37.

Specimen: Shows unerupted, impacted lower third molar.

Figure 38.

Roentgenogram: Shows similar condition.

Figure 39.

Patient: Miss B. D.

History: Complained of indefinite pressure in jaw which made her extremely nervous; also pain in back of neck.

Roentgen Examination: Shows unerupted lower third molar.

Result of Operation: Symptoms disappeared entirely.

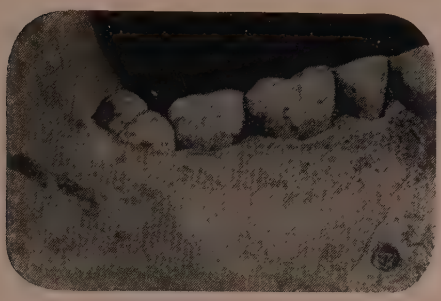


FIGURE 35.

FIGURE 37.

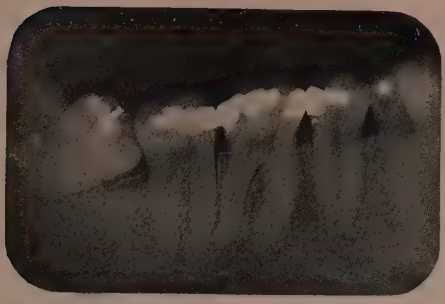


FIGURE 36.

FIGURE 38.

FIGURE 39.

Roentgenology of Unerupted and Impacted Teeth

Figure 40.

Patient: Mr. F. P., age 17.

Roentgen Examination: Shows unerupted and incompletely formed third molar.

Figure 41.

Patient: Same person two years later.

Roentgen Examination: Shows that the tooth has changed its position and has become impacted.

Figure 42.

Patient: Dr. B.

History: Tooth gave no trouble for several months after its discovery, but suddenly began to cause neuralgic pain.

Roentgen Examination: Shows unerupted, impacted third molar.

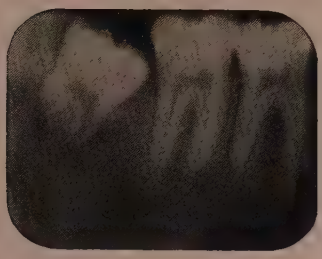


FIGURE 40.

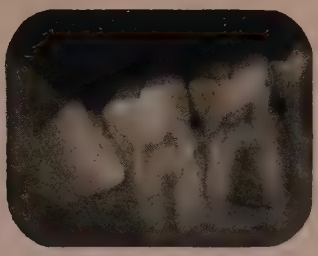


FIGURE 41.

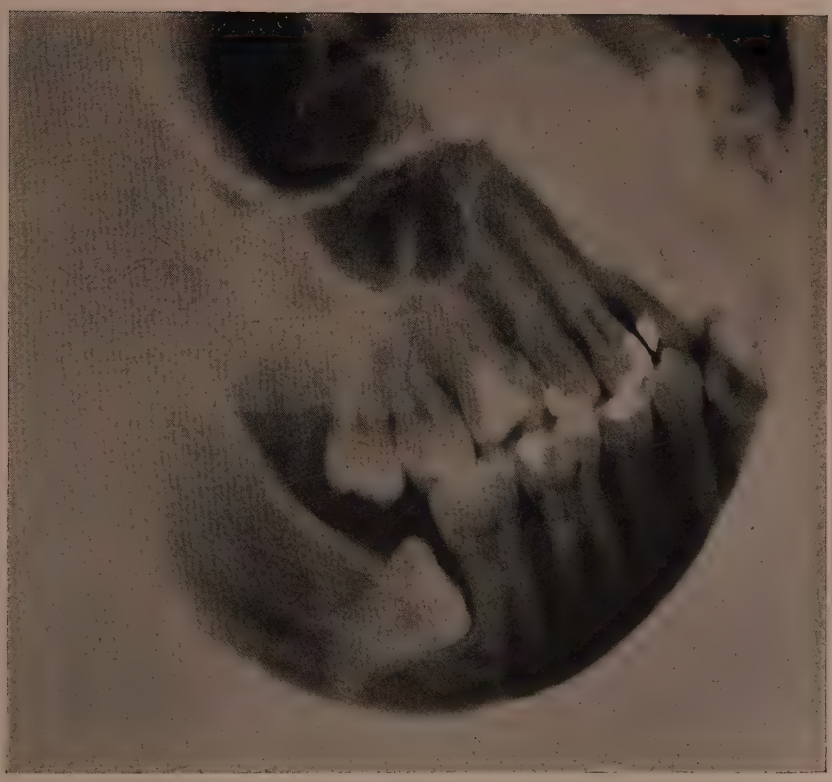


FIGURE 42.

Roentgenology of Unerupted and Impacted Teeth

Figure 43.

Patient: Mr. R. B. F.

History: Had repeated trouble with left lower wisdom tooth. The last attack was the worst, being accompanied by large swelling, difficulty in swallowing, trismus of muscles of the jaw and pus discharge around the tooth.

Roentgen Examination: Shows an impacted lower third molar with large cavity in crown, apparently involving the pulp and causing an apical abscess, as indicated by the radiopaque area around the apex of the root.

Figures 44–46.

History: All three cases had pus pockets and caused more or less inflammation of the surrounding tissues.

Roentgen Examination: Figure 44 shows an upright lower third molar, impacted in the ramus, with a radiopaque area indicating a pus pocket. Figure 45 shows an unerupted obliquely impacted third molar. Figure 46 shows an unerupted third molar tipping backwards. The radiopaque area around the crown indicates a pus pocket.

Figure 47.

Patient: Mr. T. M. S.

History: Has ringing and aching in ear.

Roentgen Examination: Shows impacted third molar.

Figure 48.

Patient: Mrs. B. S.

History: Has pain in back of neck.

Roentgen Examination: Shows unerupted third molar on both sides.

Figure 49.

Patient: Miss A. W.

Roentgen Examination: Shows unerupted, malposed cuspid.

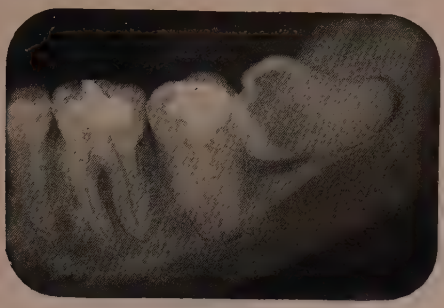
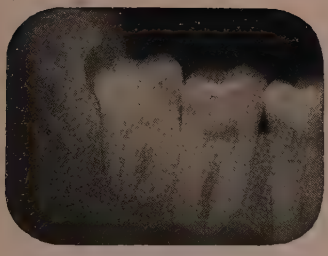


FIGURE 43.



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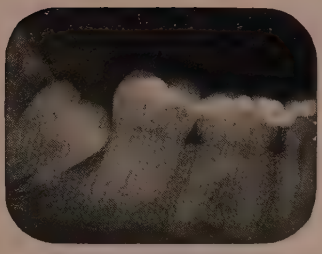

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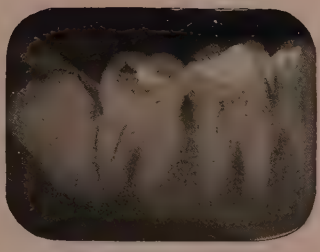

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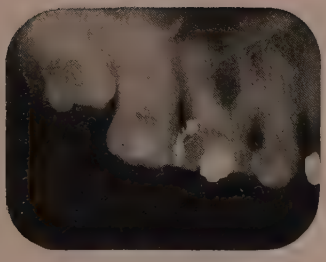


FIGURE 47.

FIGURE 49.

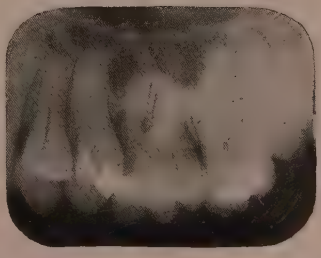


FIGURE 48.

Roentgenology of Unerupted and Impacted Teeth

Figure 50.

Patient: Mrs. E. L., age 37. Courtesy of Dr. J. M. Levy.

History: Suffered from headaches for a considerable number of years without being able to secure any permanent relief.

Roentgen Examination: Shows impacted third molar.

Operative Findings: Second and third molars had to be extracted. The distal root of the second molar had been completely absorbed and the distal surface of the mesial root also showed evidence of absorption.

Result of Operation: Patient improved a great deal, but was not entirely relieved of headaches.

Figure 51.

Patient: Dr. E. S. W.

Roentgen Examination: Shows unerupted, impacted lower molar. Its position leads to the conclusion that the distal root of the second molar has been partly absorbed.

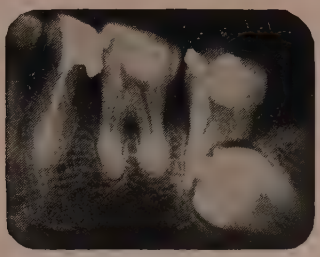


FIGURE 50.

FIGURE 51.

Roentgenology of Unerupted and Impacted Teeth

Figure 52.

Patient: Mrs. T. A.

Roentgen Examination: Shows wisdom tooth tipping forward. The roots of the second molar, which apparently was not entirely erupted, are impacted.

Figure 53.

Patient: Miss E. E.

Roentgen Examination: Shows unerupted third molar and unerupted impacted second molar.

Figure 54.

Patient: Miss C. K., age about 12 years.

Roentgen Examination: Shows lower second temporary molar impacted with root absorbed and second bicuspid unerupted.

Figure 55.

Patient: Miss W., age about 10 years.

Roentgen Examination: Shows upper temporary second molar impacted with roots absorbed. The permanent teeth are present and show normal development.

Figure 56.

Patient: Master K., age about 12 years.

Roentgen Examination: Shows lower temporary second molar unerupted and impacted, the roots being absorbed. The second bicuspid seems to have rudimentary form.

Figure 57.

Patient: Miss G. S., 12 years old.

Roentgen Examination: Shows unerupted, impacted lower second bicuspid. The impaction is probably due to early loss of the second temporary molar.

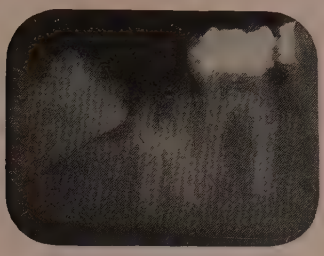


FIGURE 52.

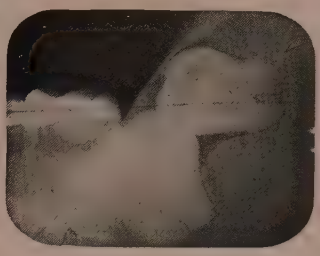
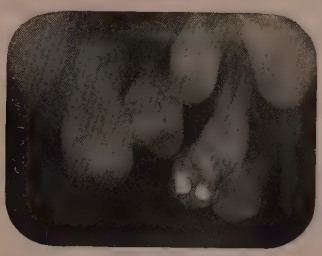


FIGURE 53.



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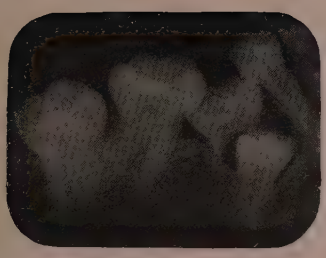

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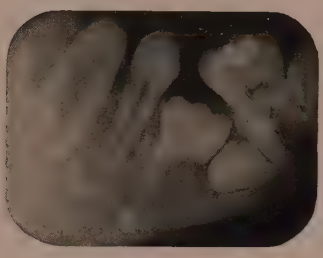

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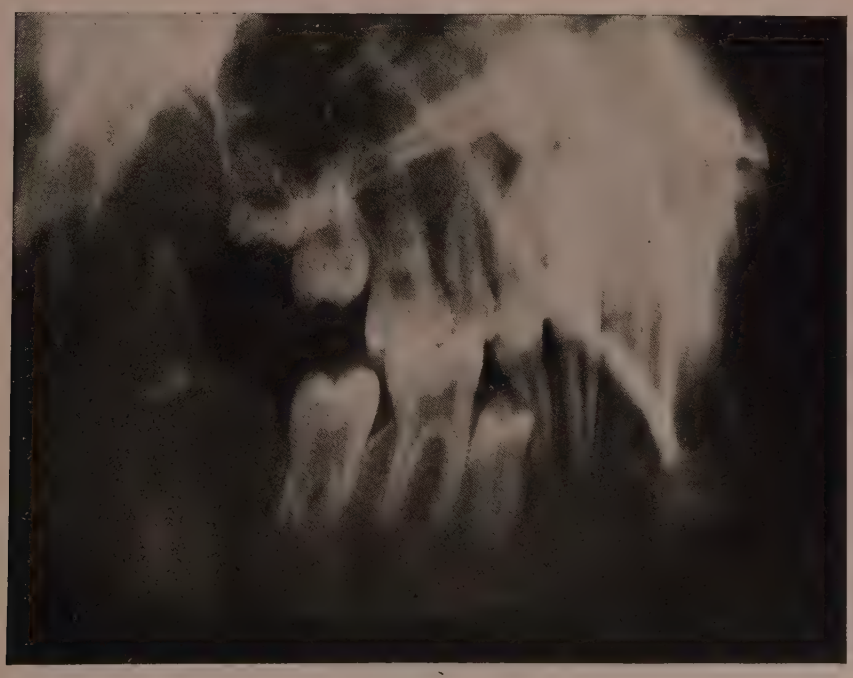


FIGURE 57.

Roentgenology of Unerupted and Impacted Teeth

Figure 58.

Patient: Miss C.

Roentgen Examination: Shows impacted and unerupted upper cuspid.

Figure 59.

Patient: Miss M. S., age 14 years.

Roentgen Examination: Cuspid did not erupt and was found in the position shown in the Roentgen picture.

Figure 60.

Patient: Miss R.

History: Had several old roots in upper jaw and pus discharge from various sinuses.

Roentgen Examination: Shows two unerupted cuspids with radiolucent areas, indicating abscess conditions, which apparently caused decay of the crowns of the teeth. Note their appearance as compared with other impacted teeth.

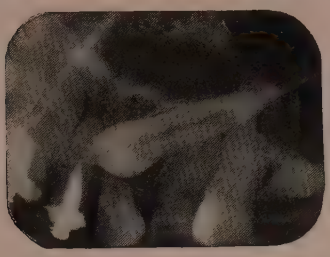
Operative Findings: The two cuspids were surrounded by abscess tissue and probably had become infected from the other teeth. The bone was necrotic and the teeth decayed at the crown.

Figure 61.

Patient: Mrs. J. C.

History: Had pain and swelling in cuspid region of lower jaw. Pus was discharged from a sinus.

Roentgen Examination: Shows unerupted cuspid. Radiolucent area around crown of tooth indicates abscess condition and the appearance of the crown itself points to decay of the tooth. A small radiolucent area at the end of the bent root indicates abscess formation.



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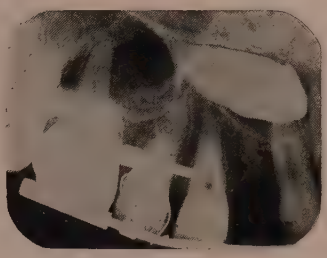

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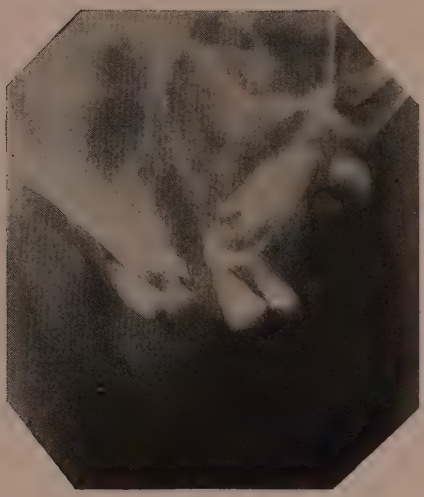

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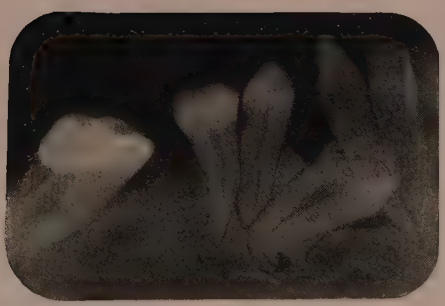

FIGURE 61.

Roentgenology of Retained Temporary Teeth; Permanent Ones Missing

Figure 62.

Patient: Mr. G., age 26 years.

Roentgen Examination: Shows that the retained temporary tooth has an absorbed root, the permanent tooth being absent.

Figures 63–66.

Patient: Mr. W. C. B., age 28 years.

Roentgen Examination: On the right upper side the second temporary molar has been retained. Its roots are entirely absorbed and both permanent bicuspids are absent. On the left upper side, both temporary molars have been retained. The same is true of the left lower side. In neither of the pictures is there any evidence of the permanent teeth. Also, on the right lower side, the bicuspids are absent. The temporary teeth have been shed, except for a small piece of root.

Figure 67.

Patient: Miss B. T., age 14 years.

Roentgen Examination: The retained second temporary molar shows only slight absorption of the roots. There is no bicuspid present.

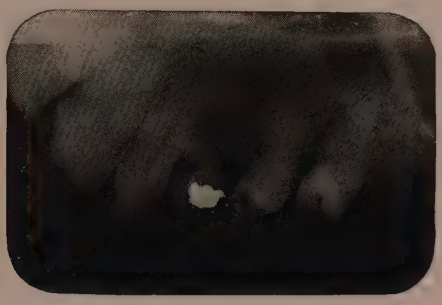

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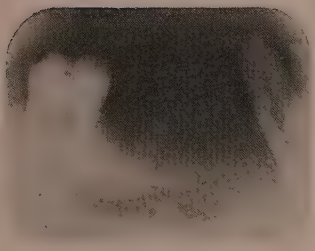
FIGURE 63.

FIGURE 64.



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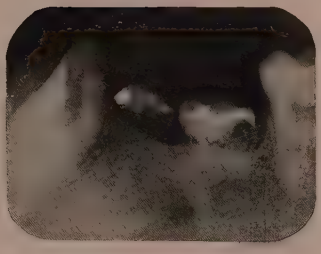

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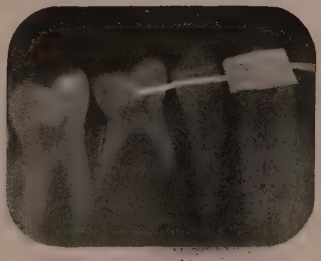


FIGURE 67.

Roentgenology of Retained Temporary Teeth; Permanent Ones Impacted

Figure 68.

Patient: Miss M. C.

Roentgen Examination: Shows temporary cuspid partly absorbed. Permanent cuspid unerupted and impacted.

Figure 69.

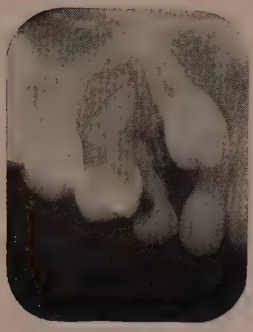
Patient: Mr. H.

Roentgen Examination: Shows that the unerupted permanent bicuspid is growing in the wrong direction and is impacted. The temporary molar, which has been retained, shows absorption of the roots.

Figure 70.

Patient: Mrs. B.

Roentgen Examination: Shows that the permanent cuspid is unerupted and impacted and the temporary cuspid shows absorption of the root. The permanent cuspid is pressing against the root of the lateral incisor, causing it to tip distally.



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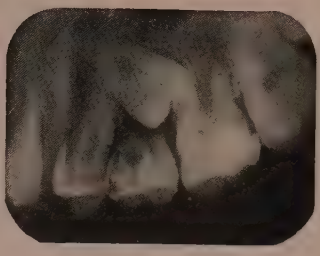


FIGURE 69.

FIGURE 70.

Roentgenology of Missing and Supernumerous Teeth

Figure 71.

Patient: Miss Sy.

Roentgen Examination: Shows absence of both upper lateral incisors.

Figure 72.

Patient: Master M., age 12 years.

Roentgen Examination: Shows both temporary and permanent lateral incisors missing on left side. The picture shows the permanent central incisor, the temporary cuspid root, partly absorbed and the permanent cuspid about two-thirds formed.

Figure 73.

Patient: Mrs. W.

Roentgen Examination: Shows unerupted third molar and rudimentary fourth molar.

Figure 74.

Patient: Mr. J. F.

Roentgen Examination: Shows first molar supplied by bridge and behind third molar a small rudimentary fourth molar.

FIGURE 71.

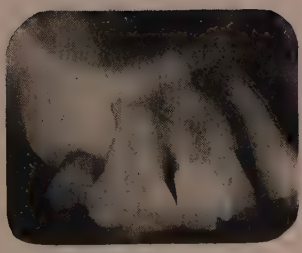


FIGURE 73.

FIGURE 72.

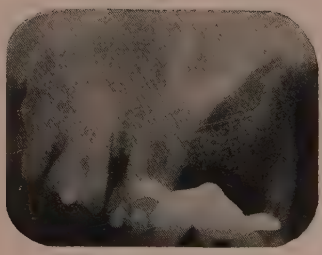


FIGURE 74.

2. Diseases of the Hard Tooth Substances

The diseases of the hard tooth substances are nearly always obvious, with the exception of affections of the root ends, which will be discussed in connection with alveolar abscesses. There are cases, however, where the Roentgen ray is useful in diagnosis.

Abrasion. This is a physiological process, the tooth having been worn down from mastication. In these days, when almost all of our food is cooked and soft, we rarely find bad cases of abrasion, but with our ancestors it was the greatest etiological factor in the involvment of the pulp and of alveolar abscesses, as is evidenced in the skulls of the ancient Egyptians and various tribes of the old as well as the new world. Abrasion also occurs sometimes on single teeth, due to malocclusion or loss of the supporting back teeth. From a Roentgenogram we can get an idea of how far the process has progressed toward the pulp chamber and how much the pulp has receded. This is important to know when restauring lost tooth substance or if making appliances to protect the tooth from further harm.

Fractures. Teeth which have received traumatic injury from blows, falling, accidents, etc., should always be Roentgenographed, as fractures occur quite frequently below the surface of the gum and cannot always be diagnosed by digital examination. Front teeth are most frequently injured and the line of fracture is generally in a horizontal direction. Roots to which porcelain crowns are attached by means of posts, however, split vertically. If the vertical fracture lies in a labio-lingual or bucco-lingual plane, it can be easily demonstrated on the Roentgen film, while the disto-mesial fracture is not always visible in the Roentgenogram.

Caries. This most frequent dental disease is, as a rule, easily recognized, but at times obscure decay may be discovered in a Roentgenogram under a gum margin or beneath a filling or crown, causing neuralgia or sensitiveness to heat, cold and sweets. The Roentgen picture also depicts accurately the amount of pulp recession and the deposit of secondary dentine, due to the process of decay (see Figure 83).

Odontomata. A tumor of the teeth is made up of the various tooth tissues, one or more of which may enter into its composition. It may be attached to another tooth or made up of two or more teeth fused together;

sometimes they are undefined masses, held together by cementum. The latter are more dangerous, as they may attain great size and disfigure the face. They are also liable to crowd the teeth out of position, and cause neuralgia. The Roentgen diagnosis is important in such cases, as it helps to differentiate the odontorna from other conditions, such as osteoma, osteosarcoma and cysts.

Roentgenology of Abrasion

Figure 75.

Specimen: From dry skull.

Photograph: Shows mandible with abrasion of the teeth, the pulp of the first molar having become exposed.

Figure 76.

Specimen: From dry skull shown in Figure 75.

Roentgen Examination: Shows close relation of the occlusial surface with pulp chamber. A radiolucent area at the ends of the roots of the first molar indicates abscess conditions, due to exposure of the pulp.

Figure 77.

Patient: Mr. McK.

Roentgen Examination: Shows that the pulps have receded a considerable distance on account of abrasion.

Figure 78.

Patient: Mr. T. B.

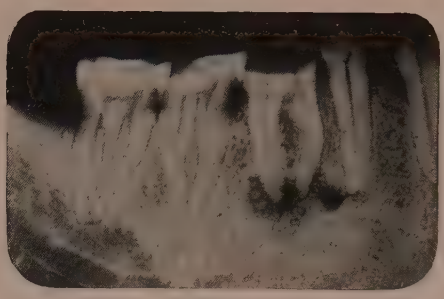
Roentgen Examination: Abrasion of the front teeth has caused the pulps to recede.

Figure 79.

Patient: Mr. P. G.

Roentgen Examination: Shows the relation of the pulp of the molar to the worn-off occlusial surface.

FIGURE 75.



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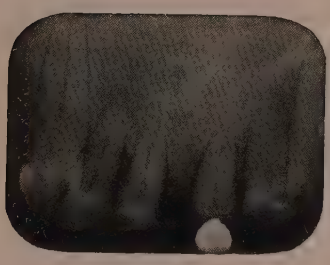


FIGURE 77.

FIGURE 78.

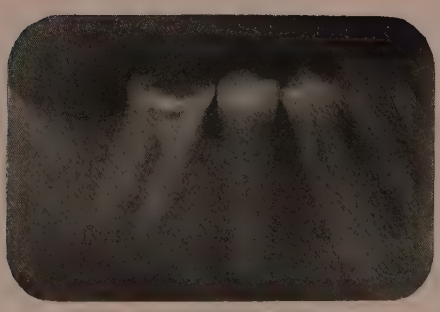


FIGURE 79.

Roentgenology of Tooth Fractures

Figure 80.

Patient: Mr. W.

History: Patient received blow sometime ago and the tooth had to be devitalized and the root canal filled. An abscess formed, however, causing swelling of gum and soreness.

Roentgen Examination: Shows fractured root with root canal filling in lower part. The radiolucent area between and around the fracture indicates an abscess condition.

Figure 81.

Patient: Mr. R. S. C.

History: Patient was hit with hockey stick. Considerable swelling on gum and some pain. The tooth was very sore.

Roentgen Examination: Shows fractured root.

Figure 82.

Patient: Mr. McK. C.

History: Patient was in motorcycle accident. The upper front teeth were slightly broken at edge, the left upper incisor was very tender and there was a slight swelling over the gum.

Roentgen Examination: Shows fracture of root. The small radiolucent area at the apex shows the beginning of an apical abscess.

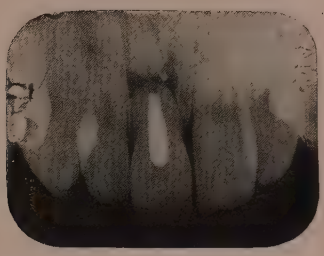


FIGURE 80.

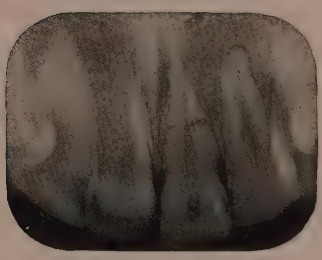


FIGURE 81.

FIGURE 82.

Roentgenology of Tooth Decay

Figure 83.

Patient: Miss W.

Roentgen Examination: Shows pulps very much receded laterally and towards the apex on account of decay.

Figure 84.

Patient: Miss P.

History: Patient complains of ear ache on right side and she also had occasionally what she called "face ache" on the same side. No pain in the teeth. She consulted two dentists, who could find no trouble.

Roentgen Examination: Shows large decayed area under filling at distal side of right lower second bicuspid. A radiolucent area at the apex of the tooth indicates that the pulp had become affected and caused an apical granuloma.

Result of Operation: After extraction of the tooth and curetting of the bone, the symptoms disappeared promptly.

Figure 85.

Patient: Mr. C. M. R.

History: Had arthritis in hip and knee for $2\frac{1}{2}$ years. Teeth apparently sound.

Roentgen Examination: Besides several other teeth the left lower first bicuspid showed a large radiolucent area at the apical part, indicating an abscess condition. This was evidently caused by a diseased pulp which became infected by decay. Note the radiolucent area under the filling in distal side of tooth.

Figure 86.

Patient: Mrs. F. A. S.

History: Obscure neuralgia, especially in right upper jaw.

Roentgen Examination: Shows a radiolucent area on the cervical part of the root of the lower second molar and a cavity at the distal side, all concealed under the gum.

Result of Operation: Extraction of the tooth stopped the neuralgia entirely.

Figure 87.

Patient: Mrs. F. A. S.

History: Pain in left lower jaw.

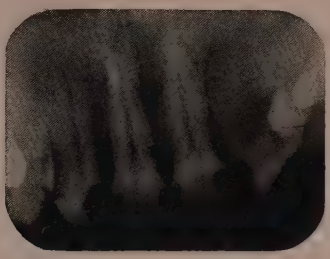
Roentgen Examination: Shows decay on distal side of left lower molar, in close proximity to the pulp.

Figure 88.

Patient: Mrs. W. V. B.

History: Pain from hot and cold food.

Roentgen Examination: Shows decay under filling of left lower molar.



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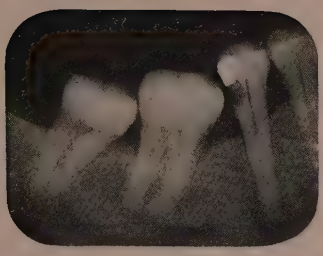

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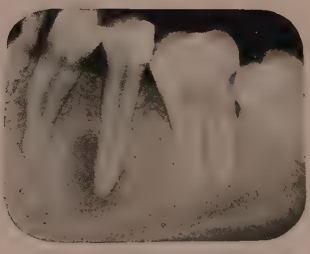

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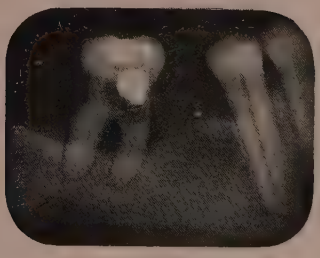

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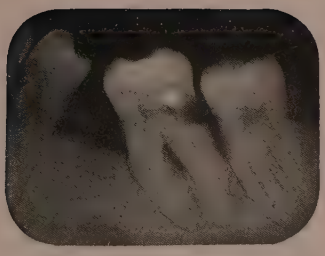

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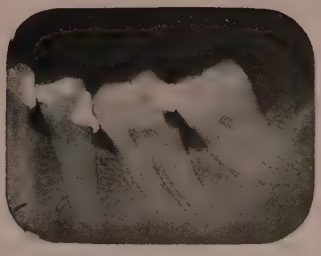


FIGURE 88.

Roentgenology of Odontomata

Figure 89.

Patient: Mrs. E. B.

Roentgen Examination: Examination for infectious foci revealed odontoma.

Operative Findings: The odontoma was made up of two lower molars grown together, one in upright and one in transverse position. The first tooth was well formed, the other having the general appearance of a lower molar.

FIGURE 89.

Roentgenology of Odontomata

Figure 90.

Patient: Mrs. I. A. V.

History: Patient had frequent attacks of severe neuralgia.

Roentgen Examination: Shows lower unerupted and impacted wisdom tooth. The wisdom tooth in the upper jaw is also unerupted and has an extension of round appearance and radiopaque character at the distal part of its neck.

Operative Findings: When the tooth was removed it was found that a round tumor, made up of dentine and covered with cement, was fused to its distal side.

FIGURE 90.

3. Diseases of the Dental Pulp and their Sequel, Alveolar Abscesses

The Size, Shape and Number of Root Canals. These can only be diagnosed by the Roentgen method and before treating a root canal, no matter in what condition it is, a Roentgen picture is absolutely necessary. The patient and the dentist will save much time and expense if the exact condition is determined beforehand. Not only is it important to know whether the tooth is straight or bent, whether the number of the canals is normal or abnormal, whether the apical foramen is unfinished or contains several outlets, whether the canals are accessible to the very end or whether secondary deposits of dentine or pulp stones obstruct successful treatment, but also it is important to ascertain whether a diseased pulp has affected the periodontal membrane, the tooth root and the surrounding bone, as the treatment of such cases would differ widely.

Pulp Stones. Calcarious deposits in the root canals of teeth are frequently the cause of obscure neuralgia. Besides the deposit of secondary dentine, which has already been mentioned, we have the formation of pulp stones, a deposit of lime salts in the tissue. These may occur in healthy as well as diseased pulps. In the former they appear as well defined nodules, while in the latter we often find undefined masses of calcified, necrosed tissue. Pulp stones, on account of their radiopacity, are easily recognizable in the Roentgen negative as light areas in the root canal.

Inflammatory Processes of the Dental Pulp. These are of microscopic nature and primarily cause no change which would affect the radiability of the tissue. It is sometimes possible, however, to diagnose a diseased pulp by finding a condition which we know to be a cause of pulp disease, such as decay beneath a filling or a pus pocket reaching the apical end of an otherwise sound tooth. When looking for the cause of an obscure pain or an enlarged lymph gland we occasionally find an area around the root of a tooth which has no history of pulp removal. The area may be well defined and very radiolucent or may only show an indistinct zone of induration. Such conditions indicate that the pulp in the tooth has become diseased and affected the tissues without.

The sequels of pulp disease furnish, perhaps, the greatest field for oral Roentgenography. There are two chains of pathological changes

which may result, the first starting as an acute suppurating inflammation and the second stimulating new inflammatory growth, which ends in a granuloma. It is impossible to tell from a Roentgen picture whether a radiolucent cavity in the bone contains pus or granulation tissue or whether the process is acute or chronic.

Acute Periodontitis and Acute Alveolar Abscesses. These are sequels of pulp disease which involve destruction of the periodontal membrane. The stratum durum of the alveolar socket becomes involved and in some cases a large amount of bone may become destroyed, while in other cases, where the apex is near the surface and covered by only a thin layer of bone, the pus burrows its way quickly to the outside, finally collecting under the periosteum or gum. The swelling of the soft tissue is sometimes quite considerable and is called subperiosteal or subgingival parulis. Roentgenograms of acute alveolar abscesses at times show large radiolucent areas, but quite frequently we find no sign of an abnormal condition, due to the fact that no bone has been destroyed, the pus having collected between the gum and bone.

Chronic Alveolar Abscess. After the pus has found an outlet to the surface, the swelling subsides slowly, but if the cause has not been removed, the condition passes into the chronic stage. Inflammatory granulation tissue is formed in the bone cavity, which discharges varying quantities of pus for months or years. A Roentgenogram of such a condition shows a dark area, indicating the radiolucent cavity in the bone filled with granulation tissue. Roentgenographically this condition cannot be distinguished from the following:

Proliferating Periodontitis and Dental Granuloma. Not until the Roentgen picture came into use for dental work was it discovered that devitalized teeth, although apparently firm and sound and giving no discomfort, are the cause of chronic inflammatory processes, harbored in the maxillary or mandibular bones. Since the pathology and bacteriology of these symptomless lesions has been studied more carefully and since we know that they are frequently foci of somatic diseases, we have discovered the grave fact that these septic conditions are of a most deceiving nature and may be more dangerous than abscesses of acute and violent character. We also realize now the importance of making a most careful search for these lesions, which can usually be diagnosed by the Roentgen method.

Apical Granuloma. The most common seat of these lesions is the periapical region, at the outlet of the root cana from which the disease starts (see Figure 113).

Interradicular Granuloma. The floor of the pulp chamber of multi-rooted teeth is sometimes penetrated by burs or root canal instruments, causing a granuloma between the roots (see Figure 114).

Lateral Granuloma. Sometimes teeth have accessory foramina as high up as the middle of the root. These may become the source of trouble if the pulp is diseased. Granulomata at the side of a root are, however, more commonly caused by perforations made with instruments (see Figure 115).

Proliferating *periodontitis* is caused by the poisonous products of bacterial decomposition and fermentation which stimulate new protective growth in the periodontal membrane. It is recognizable at an early stage by a thickening at the part where the irritation occurs. The Roentgenogram shows an increase in the size of the radiolucent line representing the periodontal membrane (see Figures 116–118).

A granuloma is made up of a fibrous capsule containing granulation tissue infiltrated by a large mass of plasma cells, lymphocytes and polymorphonuclear leucocytes. In the center we sometimes find a process of destruction which may result in a so-called subacute attack. The proliferation goes on until the lesion has grown to about the size of a pea, although larger granulomata are not uncommon. The growth of the granuloma occurs at the expense of the bone (see Figure 119), and being more radiolucent than the latter, it shows as a dark area in the Roentgen picture. It must also be remembered that the bone destruction is not the only factor. The picture of the radiolucent area depends upon the thickness of the bone surrounding it, as well as its make-up. In the lower jaw, therefore, on account of the thickness of the two dense bone plates, and where only the cancellous part may be destroyed, we will not get as dark a picture as we would in the upper jaw, where the buccal or lingual cortical plate is generally affected also. While there is, as a rule, little doubt in making a Roentgen diagnosis about a single-rooted tooth, it is more difficult with the multi-rooted upper teeth. The upper first bicuspid should be Roentgenographed from a bucco-mesial direction, while two Roentgen pictures are necessary to show distinctly the condition of the two buccal roots and the palatal root of a molar. The first is

taken about perpendicular to a plane drawn through the buccal roots and the second perpendicular to the palatal root.

Subacute Attacks. If the destructive process becomes severe, a subacute attack may occur with a large amount of pus collecting under the periosteum or gum, the patient experiencing symptoms of acute inflammation. Roentgenograms of such conditions usually reveal only a small radiolucent area, although the accumulation of pus under the gum may be quite considerable. This is due to the fact that it is not the pus which shows in the picture, but the bone destruction. The tooth causing the trouble will be found to be devitalized and treated, which differentiates it from the acute attack occurring on a tooth, the pulp of which has only been diseased a short time and where there is no evidence of previous root canal work.

Results of Alveolar Abscesses on the Root Apex. Acute or chronic inflammation, whether due to acute periodontitis, acute abscess, proliferating periodontitis or granulomata, if of any duration, leaves its mark on the apex of the root.

Exostosis of the Root Apex. Chronic inflammation is a continued irritation and causes stimulation of the cementoblasts, which produce new cementum. This results in hypercementosis, which is usually restricted to the seat of the disease, that is, the apex of the root. This thickening or bulging of the root is called exostosis and makes extraction of the tooth an extremely difficult operation. The condition, if occurring in the mesiodistal direction, is easily recognizable in the Roentgenogram by the abnormal form.

Necrosis of the Root. If the apical part of the periodontal membrane has become destroyed, the blood supply of the devitalized tooth is doubly cut off. The cement becomes infected and shows a rough surface. In this condition it is an obnoxious foreign body, which nature tries to eliminate. A process of absorption starts at the apex, similar to the process of necrosis in bone, but while in bone such parts become separated and are expelled as sequestra, in a tooth the root becomes more and more absorbed and the whole organ has to be considered as the sequestrum. In the Roentgen picture, necrosis of the tooth root is recognized by the poorly defined outline at the apex and, in the later stages, by actual loss of part of the root.

Roentgenology of Pulp Canals

Figure 91.

Specimen: Prepared skull, reproduced by courtesy of Dr. Hopewell-Smith.

Photograph: Shows normal pulp canals.

Figures 92–95.

Roentgen Examination: Shows abnormally formed roots.

Figure 96.

Roentgen Examination: Shows two root canals in lower second bicuspid.

Figure 97.

Roentgen Examination: Shows accessory canal in apical part of root of an upper central incisor.

Figure 98.

Roentgen Examination: Shows pulp canal of lower second bicuspid and second molar wide open. The patient was about eleven years old.

FIGURE 91.

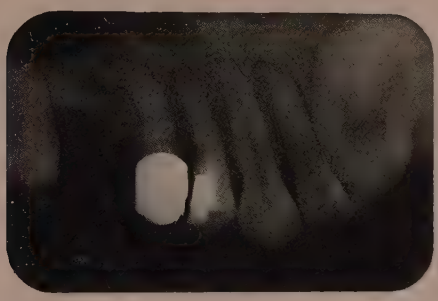
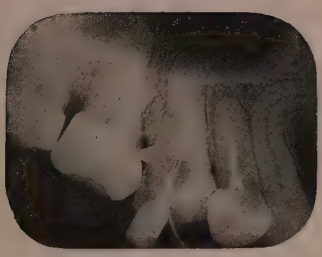


FIGURE 92.



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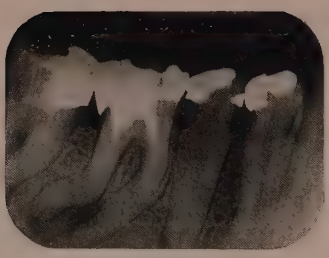

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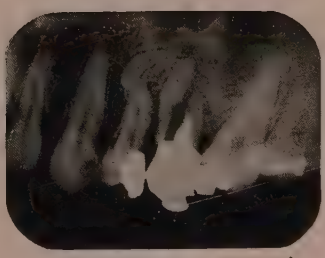

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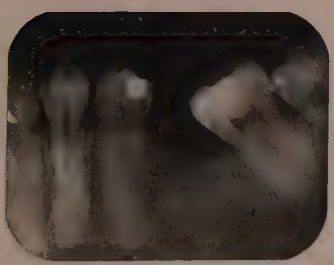


FIGURE 96.

FIGURE 97.

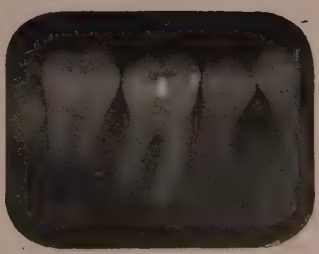


FIGURE 98.

Roentgenology of Pulp Stones

Figure 99.

Specimen: Dental pulp in situ. Stained with Mallory's phosphotungstic acid Hematoxylin. Several pulp stones are shown in the picture.

Figure 100.

Patient: Mrs. V. G. L.

History: Had attacks of neuralgia at intervals on left side of face. For three days had been in severe pain, which was especially located in the ear and zygomatic region. Blocking of the posterior, superior alveolar nerves with novocain suprarenin synthetic stopped the pain at once.

Roentgen Examination: Shows pulp stones in the upper second and third molars.

Result of Operation: Removal of the pulp and pulp stones relieved all symptoms.

Figure 101

Patient: Mrs. J. B., age about 75 years.

History: Suffered for years with severe neuralgic pains. Two suspicious teeth, which had been extracted previously, proved to have had no effect. Blocking of the inferior alveolar nerve stopped the pain.

Roentgen Examination: Shows pulp stones in both remaining molars.

Result of Operation: No recurrence of attacks after removal.

Figure 102.

Patient: Miss H.

Roentgen Examination: Shows calcarious deposits in pulp canals.

Figure 103.

Patient: Miss E. S.

History: Patient had been suffering for years with very severe neuralgia on both sides.

Roentgen Examination: Shows pulp stone in pulp chamber of left lower first molar, as well as in other teeth not reproduced.

Result of Operation: Removal of the pulp stones did not relieve the condition.

FIGURE 99.

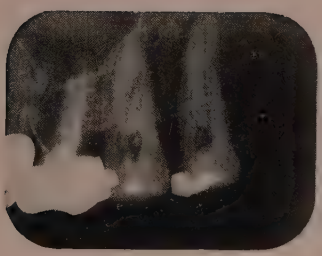


FIGURE 100.

FIGURE 101.

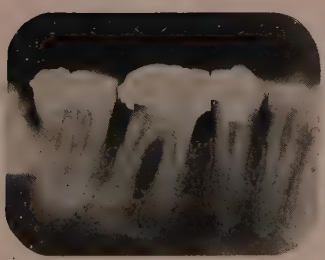


FIGURE 102.

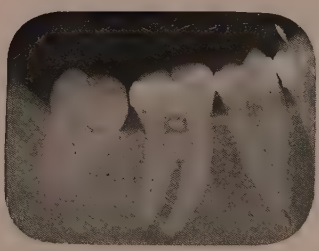


FIGURE 103.

Roentgenology of Pulp Disease

Figure 104.

Patient: Miss K.
History: Patient complained of soreness and pain in tooth.
Roentgen Examination: Radiolucent area around each root of the lower second molar, indicating apical periodontitis. As there is no other cause, we conclude that the pulp must be diseased.
Operative Findings: Pulp found to be diseased when opened into.

Figure 105.

Patient: Mrs. E. M.
History: Lower third molar slightly sensitive on percussion with occasional soreness.
Roentgen Examination: Radiolucent area around root indicating apical periodontitis. Filling seems very close to pulp.
Operative Findings: Pulp necrotic.

Figure 106.

Patient: Mr. W.
History: Tooth is very sore and surrounding tissues inflamed. Heat causes pain.
Roentgen Examination: Filling superficial. Pus pocket on mesial side and radiolucent area, indicating abscess formation around apex. From Roentgen examination we may conclude that the pus pocket has reached the apical part of the tooth and started an alveolar abscess, causing inflammation of the pulp.

Figure 107.

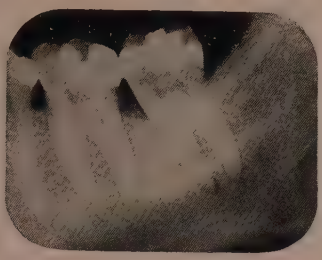
Patient: Miss P.
History: Ear ache on right side and occasionally what she called "face ache" on same side. No pain in teeth.
Roentgen Examination: Shows large radiolucent area indicating decay under filling of right lower second bicuspid; also radiolucent area at apex of tooth. From these findings we may conclude that the pulp is diseased.
Operative Findings: Pulp found to be necrotic.

Figure 108.

Patient: Mr. C. S. B.
History: Complained of tenderness under jaw. No pain and no other symptoms. Examination showed swelling of the submaxillary lymph gland, which was quite tender. The two cervical glands were also involved. Examination of the mouth revealed nothing except large amalgam fillings in the posterior teeth.
Roentgen Examination: A picture of the lower teeth shows a large slightly radiolucent area, extending from the roots of the second molar. The inflammatory process has apparently involved only the cancellous part of the bone. The cortex is extremely thick in this region and, therefore, the radiability is only increased a little. I concluded that the pulp must have become infected in this tooth.
Operative Findings: On opening the tooth, the pulp was found to be extremely putrescent. After proper treatment the glands became normal.

Figure 109.

Patient: Miss F. G.
History: Slight amount of pain felt at angle of jaw. Examination of mouth showed well-cared-for teeth with large fillings.
Roentgen Examination: Shows a radiolucent area of well defined character on the roots of the lower first molar. A dark area under distal part of filling indicates decay. The conclusion from these findings is that the pulp has become infected from the decay and caused apical abscesses.
Operative Findings: Pulp putrescent with very marked odor of decay.



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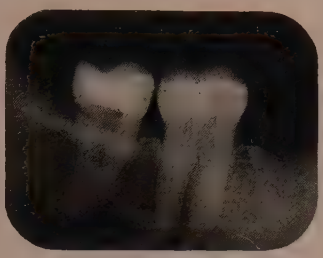
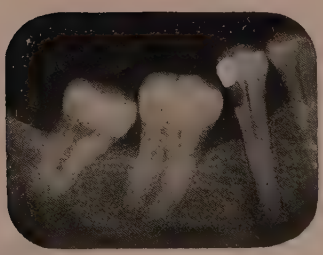


FIGURE 105.

FIGURE 106.



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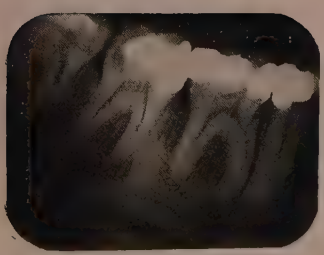

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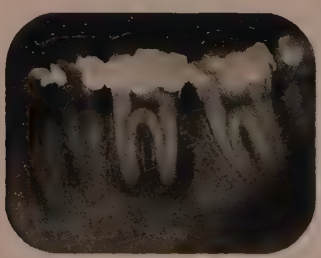


FIGURE 109.

Roentgenology of Acute Alveolar Abscess

Figure 110.

Patient: Mr. G. T.

History: The upper central incisor had recently been filled on labial surface. The tooth started to ache and the condition grew gradually worse. Examination showed the left central incisor extremely loose and tender, the two neighboring teeth being in similar condition. The gum was swollen and the lip protruded.

Roentgen Examination: Shows large radiolucent area, apparently starting from left central. No indication of root canal work. This leads to the conclusion that the pulp became involved and caused an acute abscess. The pus destroyed a large amount of bone before breaking through to the surface.

Figure 111.

Patient: Miss F. B.

History: While having the teeth regulated, the right upper lateral incisor became very sore and there was a large swelling on the gum over this tooth.

Roentgen Examination: Reveals only slight rarefied area around root apex of this tooth.

Operative Findings: Tooth was opened into under general anesthesia and found putrescent. After lancing the gum, a great deal of pus escaped.

Figure 112.

Patient: Miss R. M. P.

History: Had complained of swelling under lip for several days. When examined the lip protruded very much and the submaxillary lymph gland was very tender and badly swollen. Temperature 101, pulse 102. The front teeth had large fillings, gold in the laterals and porcelain in the centrals, and were very loose.

Roentgen Examination: Shows that the fillings, although large, do not come very close to the pulps. There was tremendous swelling, but the Roentgen picture shows no radiolucent area, as would be expected with such large abscess formation.

Operative Findings: The pulp, when opened into, was found to be highly putrescent. An incision on the labial side of the gum relieved about an ounce of pus. The apex of the tooth must have been very close to the surface, because the pus evidently caused no destruction of the bone, but pierced the bone and periosteum (which accounts for the absence of pain), and accumulated under the gum.

FIGURE 110.

FIGURE 111.

FIGURE 112.

Roentgenology of the Blind Alveolar Abscess or Dental Granuloma

Figure 113.

Roentgen Examination: Shows apical granuloma.

Figure 114.

Roentgen Examination: Shows two apical and interradicular granulomata, probably caused by perforation of pulp chambers.

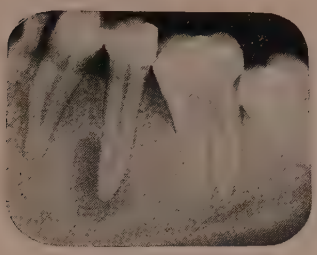
Figure 115.

Roentgen Examination: Shows lateral granuloma, caused by perforation at the side of the root.

Figures 116–118.

History: None of these three cases caused any discomfort and the teeth had been devitalized for varying lengths of time.

Roentgen Examination: Shows incomplete root canal fillings. The radiolucent area which represents the periodontal membrane is enlarged at the apical part, indicating proliferating periodontitis.



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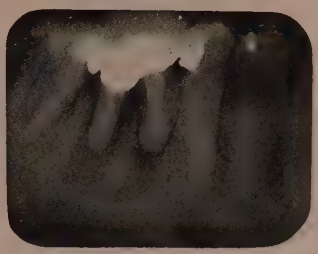

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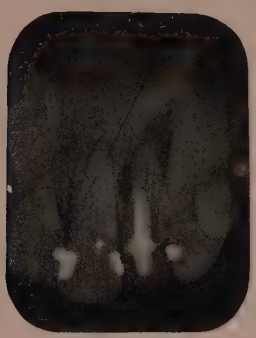

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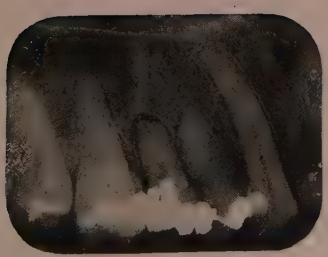

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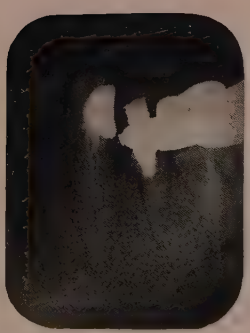

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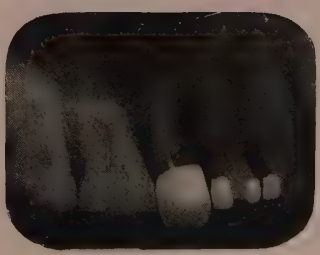


FIGURE 118.

Roentgenology of the Blind Alveolar Abscess or Apical Granuloma

Figure 119.

Specimen: Dry skull showing destruction of bone caused by a granuloma at the root of a devitalized second bicuspid.

Figure 120.

Roentgen Examination: Shows a similar condition with a radiolucent area at the apex of the tooth, representing bone destruction caused by the inflammatory process.

Patient: Mrs. B. *Figure* 121.

Roentgen Examination: Shows large radiolucent area indicating an apical granuloma. The root canal is partly filled and divides into two channels at the apex.

Patient: Mrs. C. H. C *Figure* 122.

Roentgen Examination: Shows two radiolucent areas. The one at the apex of the lateral incisor represents an apical granuloma, while the other above the central incisor at the mesial side is caused by the incisive foramen, as was ascertained in another picture.

Patient: Mr. S. *Figure* 123.

Roentgen Examination: Shows a radiolucent area around the end of the root of the first bicuspid, the root canal not being entirely filled.

Patient: Mr. J. L. S. *Figure* 124.

Roentgen Examination: Shows a large radiolucent area, indicating a granuloma caused by the devitalized lateral incisor.

Operative Findings: Apicoectomy was performed and a large cavity, filled with inflammatory granulation tissue, was found in the bone.

Patient: Mrs. W. H. C. *Figure* 125.

Roentgen Examination: Shows large radiolucent area representing a granuloma. Note the radiopaque substance in its center.

Operative Findings: Apicoectomy was performed. The bone cavity, as outlined in the picture, contained partly necrosed granulation tissue. The radiopaque substance was found to be a piece of gutta percha.

Patient: Mrs. C. A. *Figure* 126.

History: The tooth was devitalized, treated and filled many years ago. A sinus was found on the gum, through which pus discharged at intervals.

Roentgen Examination: Shows well filled root canal. At the apex, the root is more radiolucent, which indicates necrosis. The radiolucent area surrounding the tooth shows the bone destruction. The other central incisor, which is also a devitalized tooth, seems to be in normal condition.

Operative Findings: The bone cavity was found to contain inflammatory granulation tissue and pus.

Patient: Mr. P. R. P *Figure* 127.

Roentgen Examination: Two devitalized teeth are found, the right upper lateral incisor and the cuspid with root canals partly filled. Note the large radiolucent area extending way down between the cuspid and lateral

Operative Findings: Apicoectomy was performed and a large bone cavity was found, as outlined in the picture, filled with inflammatory granulation tissue.

Patient: Mrs. L. *Figure* 128.

Roentgen Examination: The left lower bicuspid shows a large radiolucent area, indicating an apical granuloma, caused by a necrotic pulp.

Patient: Mrs. J. B. C. *Figure* 129.

History: Patient had lymphangitis. From the left submandibular region the lymph vessels were seen as red lines extending to the breast and axilla. The submaxillary and cervical lymph glands were swollen. No pain in the teeth.

Roentgen Examination: Shows a radiolucent area surrounding the root of the lower second bicuspid, which is a devitalized tooth. The lesion extends way up to the cervical margin.

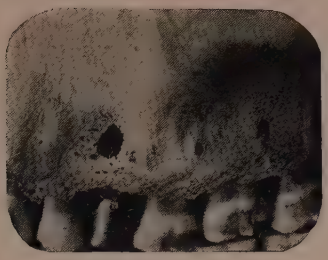
Result of Operation: After extraction of the tooth and curettage, the inflammation of the lymphatics decreased and finally disappeared.

Patient: Mrs. P. C *Figure* 130.

History: Patient had intermittent fever for three months. Temperature up to 100.5 F. Had been carefully examined for a cause without success.

Roentgen Examination: Shows radiolucent area on lower first molar, indicating a blind alveolar abscess.

Result of Operation: After extraction of the tooth, the patient's temperature remained normal.



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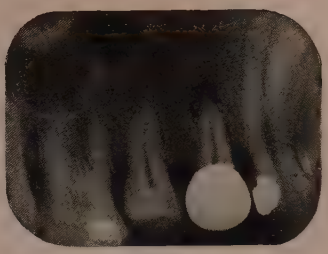

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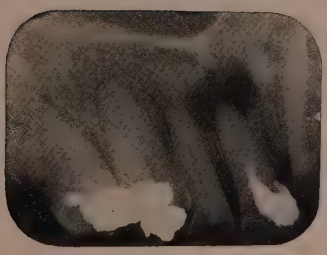

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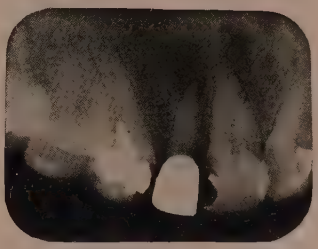

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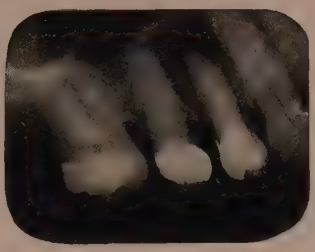


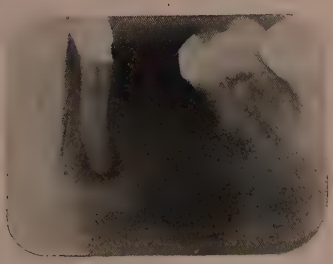
FIGURE 123.

FIGURE 124.

FIGURE 125.

FIGURE 126.

FIGURE 127.



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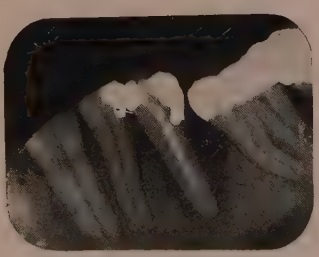

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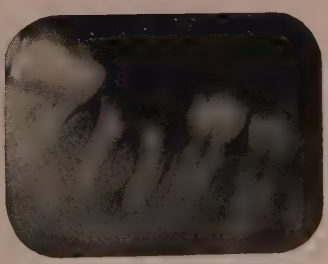


FIGURE 130.

Roentgenology of Subacute Abscesses and Scar Bone

Figure 131.

Patient: Mrs. W. R. B.

History: Upper first bicuspid had been devitalized and treated a long time ago. It occasionally felt sore and caused a slight swelling on the gum. When examined there was a large abscess formation under the mucous membrane of the hard palate, the swelling being about the size of a pigeon's egg.

Roentgen Examination: A small radiolucent area is seen at the apex of the first biscupid, representing the amount of bone destroyed. The large swelling and accumulation of pus does not show in the picture, except that it is not very clear, because the film could not be held close to the teeth.

Figure 132.

Patient: Mrs. W. G.

History: Patient had chills, temperature 102½F. Large swelling on cheek and gum.

Roentgen Examination: Shows radiolucent areas on the roots of the first molar and a large area over the second bicuspid, extending between the two teeth and indicating that a great deal of bone has been destroyed by the inflammatory process.

Operative Findings: After extraction of the tooth, a great deal of pus escaped from the socket.

Figure 133.

Patient: Mr. C. F.

History: Several years ago he had an acute abscess on the lower second bicuspid. The tooth was treated and filled.

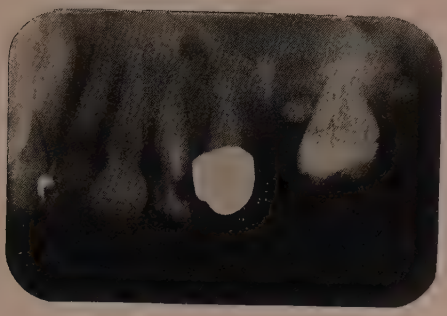
Roentgen Examination: Shows incomplete root canal filling and a radiolucent area surrounding the root of the tooth. This is surrounded by a larger radiopaque area, which represents scar-bone that has filled in the place destroyed by the acute suppuration.

Figure 134.

Patient: Mr. W.

History: He had a very severe attack of acute abscess on the lower first molar many years ago.

Roentgen Examination: Shows root canals partly filled and a radiolucent area indicating the part where there is still chronic inflammation tissue. The radiopaque area indicates that scar-bone has filled in the part which was destroyed.



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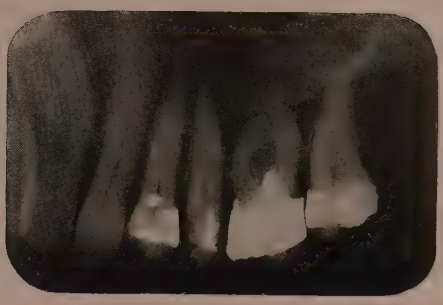
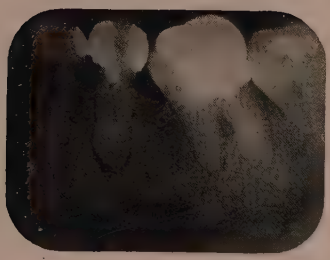


FIGURE 132.



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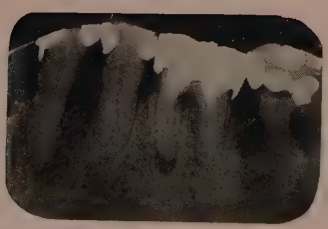


FIGURE 134.

Roentgenology of Exostosis and Necrosis of the Tooth Roots

Figures 135 and 136.

Specimen: Extracted teeth showing exostosis of the root ends, due to inflammatory conditions.

Figures 137–139.

Roentgen Examination: Show enlarged root ends in all three lower first molars, due to inflammatory processes.

Figure 140.

Patient: Mrs. W. L. W.

Roentgen Examination: Shows irregular outline of roots of lower second molar. There is a radiolucent area surrounding the root. This indicates necrosis of the root end, caused by a chronic inflammatory condition.

Figure 141.

Patient: Mrs. T. M. G.

Roentgen Examination: Shows irregular outline of mesial root of first molar, a condition which indicates absorption due to chronic inflammation.

Figure 142.

Patient: Mrs. H. G. B.

Roentgen Examination: Granulomata at the ends of the roots of the first molar are indicated by the radiolucent areas. The mesial root shows marked exostosis.

Figures 143 and 145.

Roentgen Examination: Shows in Figure 143 absorption of the palatal root of the upper first molar and in Figure 145 absorption of the end of the lateral incisor.

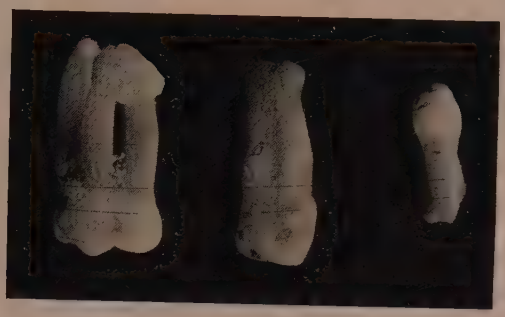
Figure 144.

Patient: Mrs. I. O. H.

History: Patient says she had periostitis 30 years ago in Norway. A piece of necrosed bone was removed by her dentist. Tooth is firm and reacts on the heat test.

Roentgen Examination: Shows one root very much shortened. An irregular radiopaque area indicates scar bone and there is a radiolucent area at the distal side under the filling, which shows decay.

FIGURE 135.



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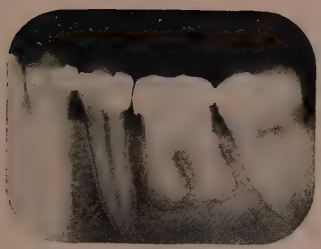
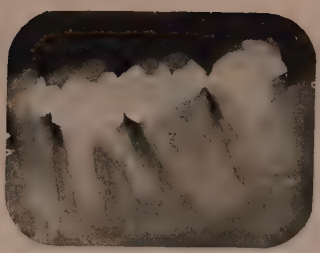


FIGURE 137.

FIGURE 138.



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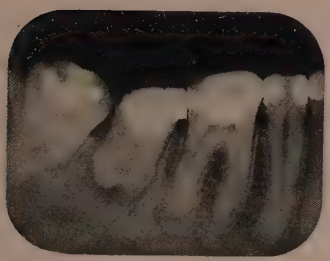

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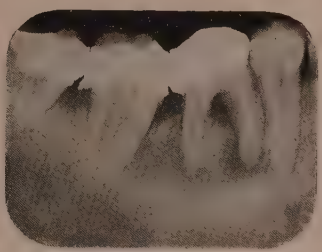

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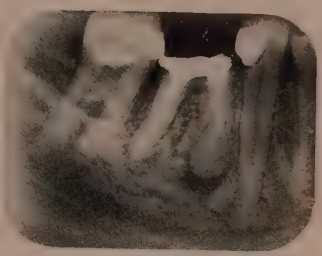

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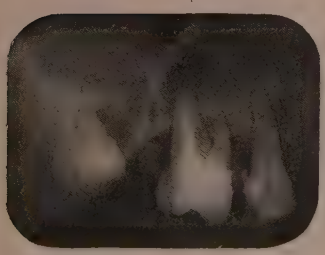

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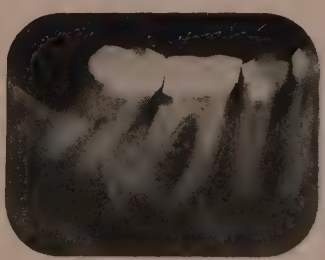

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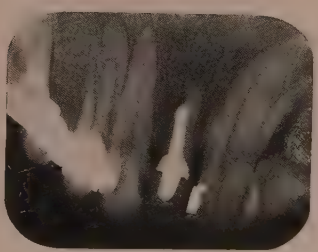


FIGURE 145.

4. Diseases of the Marginal Part of the Periodontal Membrane

Marginal Periodontitis or Pus Pockets are quite frequently found on single teeth and are due to infection of the marginal part of the periodontal membrane, with involvment and destruction of the bone which forms the alveolar socket. They are caused by injury or irritation such as come from poorly fitted gold crowns or fillings, from lack of contact between two teeth, causing food to crowd and stagnate in the interdental spaces, or from ligatures and rubber dam left around the neck of a tooth. In such cases the Roentgenogram shows a radiolucent area extending at the side of the tooth from the neck down into the tissue.

Marginal Periodontitis Due to Impaction and Difficult Eruption. This has already been taken up in connection with impacted and unerupted teeth. After the gum has been pierced, food and fluids of the mouth have a free entrance between the gum and enamel and infection of these pockets occurs quite frequently.

Pyorrhea Alveolaris. This condition, which is usually caused by systemic disturbances, starts with inflammation of the gums and later attacks the deeper tissues; namely, the periodontal membrane and the bone. It usually occurs on many or all of the teeth and the bacteria of the mouth start an infection which results in a persistent flow of pus from the alveolar sockets. The Roentgen method affords an excellent means of studying the progress of pyorrhea alveolaris, and is a valuable aid in diagnosis and prognosis of the disease, as it registers the extent to which the bone has been affected and destroyed. In early cases we see only an irregular outline of the bone edge between the teeth, the compact part of the bone having become destroyed and the remaining marginal part having a spongy appearance. Sometimes in the early stages the wall of the alveolar socket is affected, a delicate, partial decalcification of the stratum durum being noticeable, extending along the alveolus and showing a wider space between the bone and tooth. More and more of the bone becomes absorbed, the process being more rapid on teeth which, on account of malocclusion or unequal occlusion, receive a great deal of movement in mastication. In cases of long standing, we find places where the entire wall of the alveolar socket has been destroyed, forming a funnel-shaped pocket around the tooth root. In molars the septa

between the roots may also become affected, and the tooth, being finally only supported by the gum, becomes extremely loose. The cementum of the tooth gets soaked with pus and often covered with deposits of serumal calculus. Both factors contribute to the chronicity of the disease. The calcarious deposit is usually near the neck of the tooth and may be nodular or laid down in scales. It can be easily recognized in the Roentgenogram. Sometimes a Roentgen picture shows a very deep pocket almost reaching the apex, although the tooth may apparently be firm. This is undoubtedly due to the fact that the pocket is only on one side of the tooth, while on the other sides there is sufficient bony attachment to hold the tooth firm. It also demonstrates that the Roentgen picture shows principally the conditions on the mesial and distal sides of the teeth and only vague impressions of the buccal and lingual sides.

Abscesses Due to Marginal Periodontitis. Alveolar abscesses may occur without the pulp being involved, due to closing up of the outlet of a pus pocket at the gingival margin. The pus then accumulates and causes a condition which, according to the symptoms, closely resembles an alveolar abscess due to a diseased pulp. The Roentgenogram is of inestimable value in recognizing such a condition. The abscess is found on the side of the root or between the roots of multi-rooted teeth and may occur both on normal and devitalized teeth.

Large granulomata are sometimes formed between the roots of molars and, in the upper jaw, are often difficult to diagnose by the Roentgen method, although they may be the cause of severe neuralgia.

Abscesses may also come from infection of the apical tissue of a tooth if the pocket progresses to that extent. The pulp then becomes involved and may cause not only a severe apical abscess, but also pulpitis with all its well-known symptoms.

Roentgenology of Marginal Periodontitis

Figure 146.

Specimen: Skull showing destruction of the marginal part of the alveolar process about an upper first bicuspid, probably due to lack of contact.

Figure 147.

Roentgen Examination: Shows a similar condition, but caused by an ill-fitting gold crown. Note the radiolucent areas on the mesial and distal sides of the first bicuspid, indicating destruction of the bone.

Figure 148.

Patient: Miss L.

History: Patient complained of occasional soreness of the gums. Had been in a run-down condition for a considerable length of time.

Roentgen Examination: Shows on the right upper side, destruction of the alveolar process between the first and second bicuspids, second bicuspid and first molar and first and second molars, due principally to fillings and ill-fitting crowns. There is also an indication of several apical abscesses and a frontal plate showed involvment of the maxillary sinus.

Figure 149.

Patient: Mr. N.

History: No complaint except irritation of the gum around crown on lower incisor.

Roentgen Examination: The increased radiolucency on the sides of the tooth indicates a pus pocket which has just reached the apex of the tooth, the pulp being still vital.

Figure 150.

Patient: Mr. S.

History: Pus discharge around distal root of first molar.

Roentgen Examination: Shows radiolucent area indicating pus pocket around distal root and extending between the roots of the first molar.

Figure 151.

Patient: Mrs. P.

Roentgen Examination: Radiolucent area indicates pus pocket between the two bicuspids, caused by lack of contact of the filling in the first bicuspid. In the picture a temporary filling is shown which fills in the entire space.

Figure 152.

Patient: Mrs. K.

Roentgen Examination: Shows bone destruction between cuspid and bicuspid due to lack of contact of the crowns of the two teeth.

Figure 153.

Patient: Mrs. H. E. D.

History: No symptoms of discomfort or pain. Patient said tooth was devitalized and treated several years ago.

Roentgen Examination: Shows large radiolucent area indicating pus pocket surrounding the root of the incisor. This pocket was evidently started by a perforation at the side of the tooth.

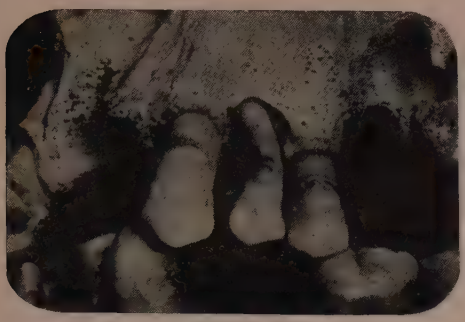
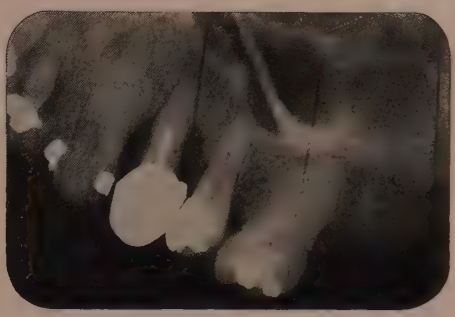


FIGURE 146.



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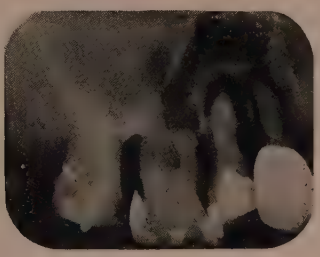
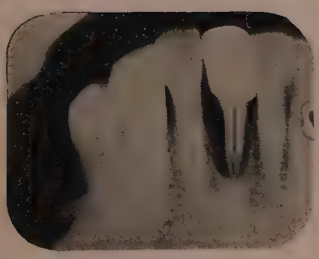


FIGURE 148.



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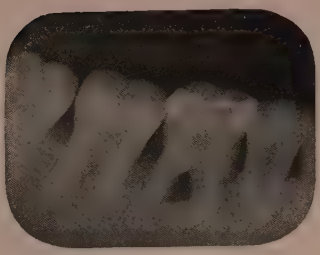


FIGURE 150.

FIGURE 151.

FIGURE 152.

FIGURE 153.

Roentgenology of Pyorrhea Alveolaris

Figure 154.

Specimen: Dry skull.

Photograph: Shows inflammatory destruction of the marginal part of the alveolar process, due to pyorrhea. The roots of the teeth show calcarious deposits.

Figure 155.

Specimen: Dry skull.

Photograph: Shows pyorrhea condition further progressed, with destruction of the alveolar process and inflammatory changes about the bone. The upper second bicuspid is especially involved.

Figure 156.

Specimen: Dry skull.

Photograph: Here deep pockets are formed. There is loss of the interdental septum between the lower cuspid and bicuspid and the first bicuspid and molar. The outer plate of the alveolar process has been destroyed about the upper central incisor, lower cuspid and first molar.

Figure 157.

Patient: Mrs. McC.

Roentgen Examination: The Roentgen picture of the lower incisors shows inflammatory changes of the bone at the alveolar margin and calcarious deposits around the necks of the teeth.

FIGURE 154.

FIGURE 155.

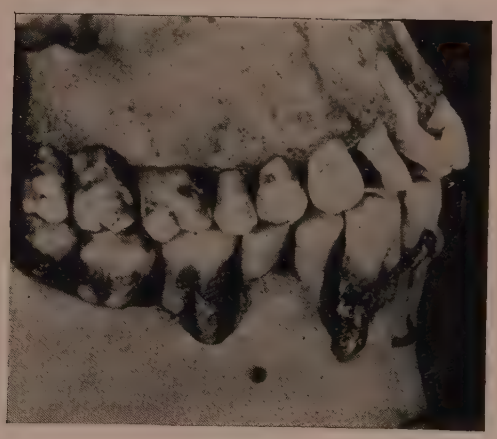


FIGURE 156.

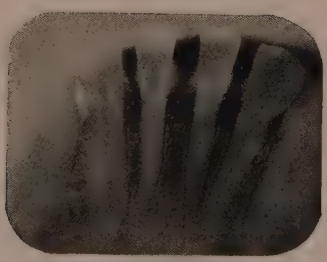


FIGURE 157.

Roentgenology of Pyorrhea Alveolaris

Figures 158 *and* 159.

Patient: Mrs. F. M. B.

Roentgen Examination: In this case of pyorrhea there are no deep pockets, but the marginal part of the alveolar bone has been affected. Note the spongy irregular appearance of the marginal part of the bone between the teeth. In Figure 158 there is a deposit on the mesial surface of the second molar. In Figure 159 the irregular outline of the distal surface of the first molar shows that the cementum of the root has been affected.

Figures 160–163.

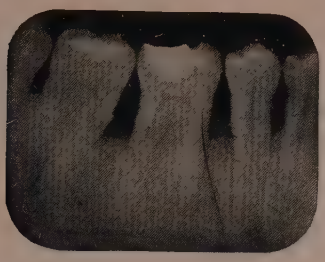
Patient: Mrs. E.

Roentgen Examination: Pyorrhea in this case has progressed much further. Deep pockets have formed, especially on the mesial sides of the first lower molars. Also in the upper jaw we find many large pockets, the left upper second molar having lost almost its entire bony support. Note that the left upper second bicuspid is a devitalized tooth and presents a dark area which, on account of clinical symptoms, represents a blind abscess or granuloma. Note the absence of calcarious deposits.

Figure 164.

Patient: Mrs. D. C. P.

Roentgen Examination: There are deep pockets between all the teeth. The bone presents a spongy appearance at its border. Note the large deposits on the root surfaces, which have the same degree of radiopacity as the tooth.



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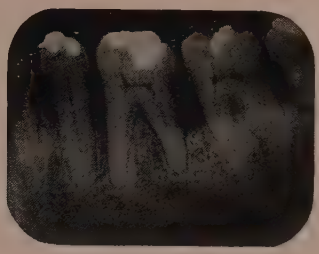

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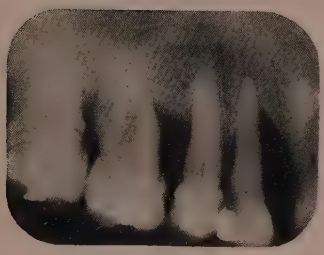

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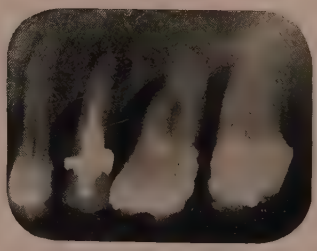

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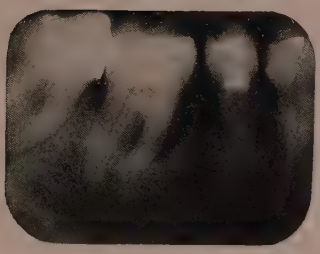

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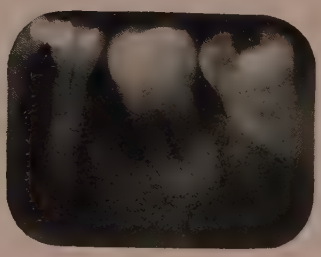

FIGURE 163.

FIGURE 164.

Roentgenology of Pyorrhea Alveolaris

Figures 165–167.

Pictures: Show lower incisors from three patients.

Roentgen Examination: In Figure 165 the bone between the roots is very spongy and has been partly decalcified. In Figure 167, a great deal of the bone has been lost, the pockets extending almost to the apices of the teeth. In Figure 166 we find the teeth entirely surrounded by radiolucent tissue, the pulps having become devitalized and been removed in two incisors. This is indicated by the small radiopaque areas, which are temporary fillings closing an opening made into the root canals. The Roentgen picture demonstrates how unreasonable it is to try to retain such teeth which show necrosis at the apex and are surrounded by diseased bone.

Figures 168–171.

Patient: Mr. G. T. S.

History: Had completely broken down with rheumatic fever and suffered from intermittent attacks of conjunctivitis of the left eye for several years. Lost a great deal of weight and for several months had been unable to attend to his duties. His teeth were loose and discharged a great deal of pus.

Roentgen Examination: Large pyorrhea pockets are shown on all the teeth. The left lower molar, as seen in Figure 171, shows entire destruction of the bone around the mesial root, including the interradicular septum and involving the pulp of the tooth.

Result of Operation: After extraction of all the diseased teeth the patient improved rapidly and in seven weeks gained about 50 pounds.

Figure 172.

Patient: Mr. A. I. E.

History: Patient had symptoms of acute abscess with swelling of gum over right upper cuspid. His dentist started to open the pulp chamber, but found the tooth sensitive. Slight inflammation of the gums about all the teeth.

Roentgen Examination: Shows a radiolucent area on the mesial side of the tooth, not extending to the apex. A fine probe can be passed into this from the gum margin which, however, is very firm. We, therefore have to do with a pyorrhea abscess on a vital tooth. Note the radiopaque area in the crown of the tooth indicating the filling placed in the attempted opening to the pulp.

FIGURE 165.

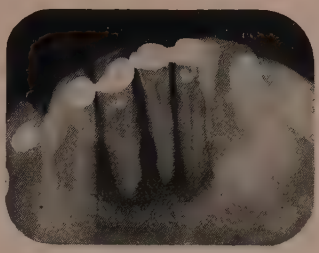

FIGURE 166.

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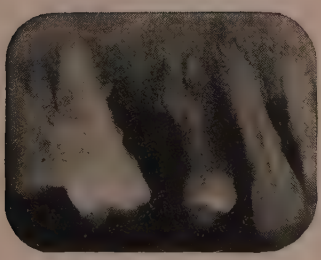

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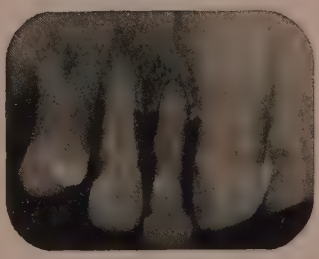

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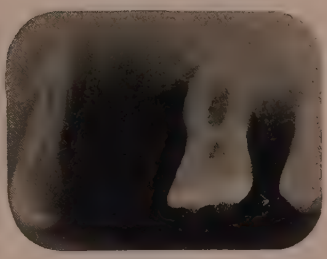

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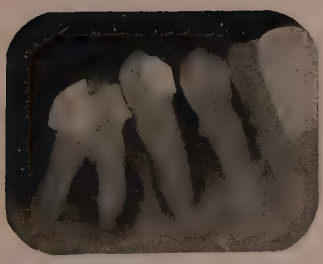

FIGURE 171.

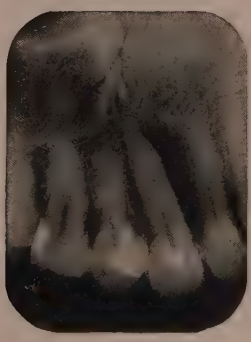

FIGURE 172.

5. Diseases of the Jaws

Atrophy. Decrease in the size of the jaws may be due either to a pathological or physiological process. Tumors and cysts cause such a decrease as well as loss of teeth, which is usually followed by absorption of the alveolar process. If all the teeth are lost in old age, the entire alveolar process disappears. This may bring the mandibular canal and mental foramen close to the surface in the lower jaw and in the upper jaw sometimes there is only a thin wall of bone between the maxillary sinus and the mouth (see Figure 173).

Fractures. Fractures occur more frequently in the lower than in the upper jaw because the maxillary bones are well protected by the zygomatic and nasal bones and below by the lower jaw. The Roentgen method is of great value in diagnosing the location and the nature of a fracture. It indicates whether it is simple, multiple or cominuted with the bone broken into small pieces and the teeth dislodged and driven into the wound.

Diffuse Osteomyelitis. If we consider the frequency of dental infections involving the jaws, it is surprising how rarely we find a case of diffuse osteomyelitis. The disease occurs most frequently in the mandible and spreads rapidly in the cancellous part, involving the whole bone and causing more or less necrosis. It is a serious disease and often a large number of sequestra are formed with occasional subperiosteal abscess formations. The teeth get very loose and the condition becomes either acute or chronic. The Roentgen ray is useful both for making an early diagnosis and for locating loose sequestra. The bone has a characteristic appearance in the picture, radiolucent channels indicating the infectious process and sequestra being easily recognized, especially if entirely separated from the bone.

Ostitis. In ostitis, not only the cancellous part but the entire bone is affected. It may start from without (periostitis), or from within (osteomyelitis), but in either case the bone dies cell by cell. Suppurating ostitis may be distinguished by the dissolving of the bone into pus, while granulating ostitis is of a more chronic nature, only a little pus being formed and granulation tissue replacing the substance of the bone. Both suppurative and granulating ostitis show plainly a large amount of bone

destruction in Roentgenograms, the destroyed part appearing very radiolucent.

Necrosis. If bone dies in masses, the process is called necrosis of the jaw, which is caused by interference with the nutrition of a part for any length of time. It may be due to an inflammatory process destroying the blood supply or to the misplacement and isolation from its source of nutrition of any part of the bone by fracture. We also find necrosis caused by toxic substances, such as mercury and phosphorus. After the bone has lost its metabolism and become a dead substance, nature makes an effort to exfoliate it. It is separated from the vital tissue by the action of osteoclasts, the separated dead part being called a sequestrum. Sequestra are obnoxious foreign bodies and cause continual irritation and suppuration. They are usually surrounded by inflammatory granulation tissue, but repair cannot take place unless they are removed. As a result of necrosis, a certain amount of callous formation may occur to protect the weakened bone. This is usually formed in excess and often causes considerable change in the contour of the part, but, as a rule, it is absorbed again later.

Necrosed bone is recognizable in Roentgen pictures by its irregular and indistinct outline and is generally surrounded by radiolucent areas representing the inflammatory granulation tissue. To ascertain whether a sequestrum is entirely separated from the rest of the bone it is often necessary to take several pictures from different angles.

Periodontal or Radicular Cysts. These are cysts of inflammatory, infectious origin and are usually formed by an epitheliated dental granuloma. Epithelial remnants of the enamel organ, which are normally found in the periodontal membrane, have a tendency to proliferate when stimulated by chronic inflammation and are apt to grow over the inside surface of the granuloma. Exudates accumulate in the lumen and as they increase the cyst grows, at the expense of the bone. A Roentgenogram will indicate a cyst clearly, showing a large radiolucent area, usually at the end of a tooth which is devitalized or has a diseased pulp sticking into it.

Periodontal cysts are sometimes found not connected with a tooth root, but in such cases the guilty tooth may have been extracted, the cyst having escaped notice, or there may have been a granuloma at the time of extraction, which, not having been removed, later grew into a cyst (see Figure 193).

In the upper jaw a periodontal cyst may grow into the maxillary sinus, sometimes filling it almost completely. Such a condition is difficult to diagnose.

Multilocular cysts start in a similar manner. They may originate either from the formation of several cysts in one granuloma, from the formation of a cyst from more than one tooth, or from the development of cysts in various medullary spaces of the cancellated part of the bone, the fluid accumulating and extending them, leaving bone lamellae in between (see Figure 192).

Follicular or Dentigerous Cysts. This type of cyst, which occurs rather rarely, is caused by the tooth follicle of an unerupted, impacted, supernumerous or misplaced tooth or tooth germ. It may contain one or many well formed teeth or rudimentary tooth masses, or it may be formed from the enamel organ without a tooth having been developed. Like the periodontal cysts, they grow at the expense of the bone, but much more slowly. We can discern them readily in a Roentgen picture on account of their radiolucent appearance and the radiopacity of the misplaced teeth (see Figure 190).

Tumors. For tumors the Roentgenogram is only of value in cases which produce bone or in which bone substance is affected and degenerated, though it is also helpful in differentiating the latter from the more superficial varieties in order to determine the mode of operation.

Osteoma. These are benign tumors and of very slow growth. They are very frequently found in the jaw, especially on the lingual surface of the mandible and the palatal surface of the maxilla. The tumor usually consists of very dense cortical bone and is, therefore, extremely radiopaque, showing as a very light, well defined area on the Roentgen picture.

Osteosarcoma. Osteosarcomata are the most frequent tumors of the bone. They grow in the bone from its connective tissue cells, as well as from bone-forming cells. When they grow in the cancellous part, they distend and destroy the bone. This condition can be recognized in the Roentgenogram and differentiated from the fibrosarcoma. When they grow from osteoblasts of the periosteum, the new trabeculae of bone can be seen extending mostly at right angles to the surface.

Carcinoma. This is a malignant, epithelial tumor which infiltrates and may give rise to metastasis. It has a tendency to invade the lymph spaces, growing into the lymph vessels and giving rise to metastasis

along the paths of absorption. A carcinoma does not occur primarily in the jaws, but bone may be secondarily affected by its destructive nature. Fatty degeneration may also occur, due to impaired metabolism, and necrosis of the soft and hard tissues is often the result of local interference with the circulation. These changes, when they affect the maxillary or mandibular bones, can be easily distinguished in a Roentgenogram.

Roentgenology of Atrophy of the Jaws

Figure 173.

Patient: Miss E. O. B.

History: Patient suffered from trifacial neuralgia on left side, especially referred to lower jaw and lip.

Roentgen Examination: A sharp spur is found in the incisor region, the alveolar process and part of the mandible having been atrophied.

Result of Operation: The pain was relieved by anesthetizing the left inferior alveolar nerve. Removal of the spur gave no relief. Neurectomy of the left inferior alveolar nerve was performed by Dr. Mixter and relieved the neuralgia.

FIGURE 173.

Roentgenology of Fractures of the Jaws

Figure 174.

Patient: Miss L. D.

Roentgen Examination: Shows position of the fragments after fixation of the teeth.

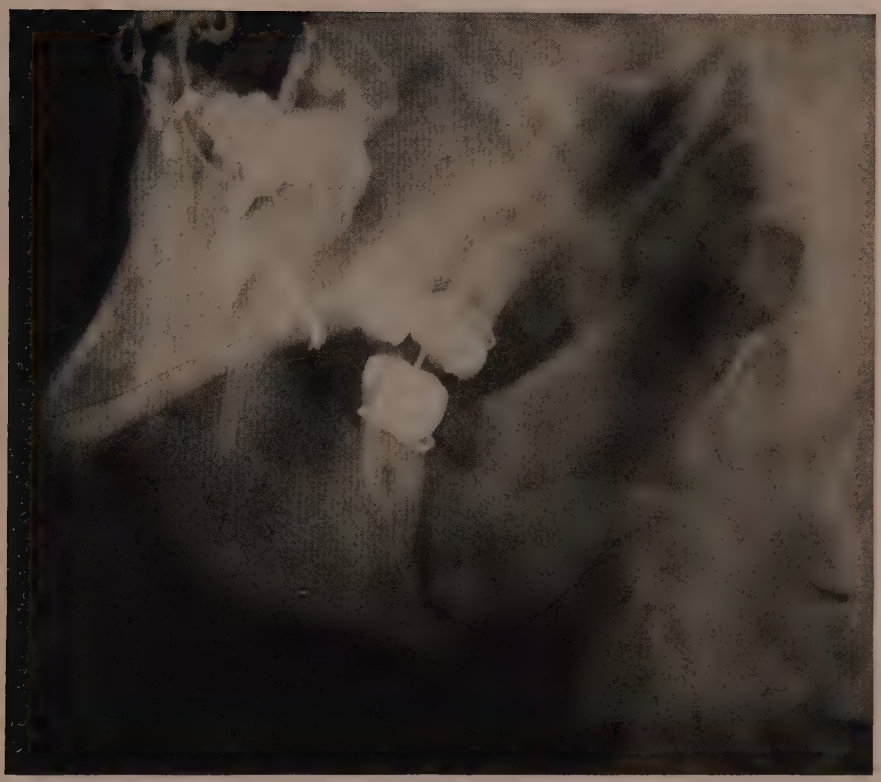

FIGURE 174.

Roentgenology of Fractures of the Jaws

Figure 175.

Patient: Mr. R. C. P.

History: Patient fractured jaw eight weeks previous to having the Roentgen picture taken. The teeth opened and closed fairly well, but the side movement was not so good, the forward movement being very poor.

Roentgen Examination: Shows fracture at the neck of the condyle and overlapping of the two fragments.

FIGURE 175.

Roentgenology of Diffuse Osteomyelitis

Figures 176 *and* 178.

Patient: Mrs. A. L.

History: Patient had a gold crown put on a tooth by her dentist on Dec. 24, 1915. Dec. 26, the tooth was extracted by another dentist, on account of an abscess condition. Dec. 28 she went to a hospital and received palliative treatment. Jan. 8, 1916, she was sent to the author for examination. She complained of pain in the lower jaw, inability to open her mouth and soreness of the lower teeth. Temperature, 99.5 F.

Examination: In the lower jaw, the following teeth were present: the left lower molar and the bicuspids, cuspids and incisors on both sides. These teeth and both right lower bicuspids were extremely loose and there was evidence of the recent extraction of the right lower first molar. The upper teeth were firm and, apparently, in good condition. Two Wassermann tests were negative.

Roentgen Examination: A large radiolucent area was found beneath the socket of the extracted right lower molar (see Figure 176). From this place to the bicuspids of the other side, the entire body of the mandible showed radiolucent areas and channels, indicating an osteomyelitic condition (see Figures 176 and 177). The same condition was found in the alveolar process, the front part of which is shown in Figure 178.

FIGURE 176.

FIGURE 177.

Operative Findings: On Jan. 20, 1916, all the loose teeth in the lower jaw were extracted and the entire cancellous part between the cortical plates was curreted. Many small sequestra were found and removed. The wound healed rapidly, but two more pieces of bone were expelled later. March 2 the patient returned with swelling and pain on the left side. Another Wassermann test was again negative and a new Roentgenogram showed that healing had taken place on the right side, but that the process of disease had involved the left side extensively (see Figure 179). An operation was performed on this side March 3 and from that time on the healing continued normally. September 8 two more sequestra became evident. One was removed from the mouth and the other from the submental region and the wounds healed by first intention. November 25 an abscess seemed to point at the angle of the jaw, where there was also considerable callous formation. The place was explored and a small sequestrum removed, but the sinus continued to discharge. A later Roentgenogram showed a normal condition everywhere except at the left angle of the jaw, where another small sequestrum was found in the middle of the bone. This was removed January 31, the sinus excised and the wound closed. The wound healed by first intention. The hard swelling disappeared gradually, so that the outline of the face was again normal.

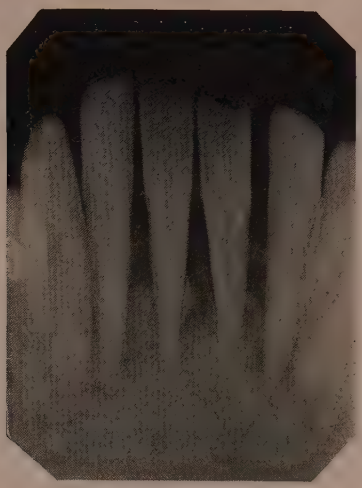

FIGURE 178.

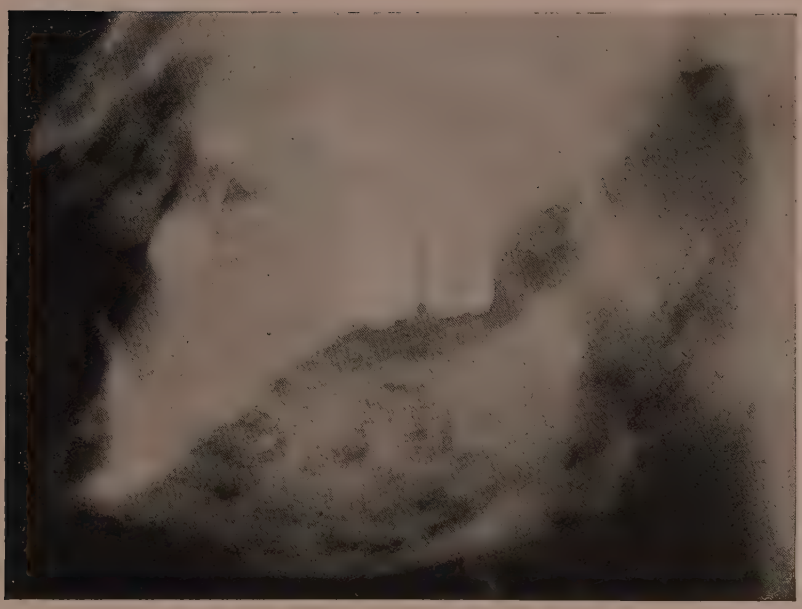

FIGURE 179.

Roentgenology of Ostitis and Negrosis of the Jaws

Figure 180.

Patient: Mr. W. C. B.

Roentgen Examination: Shows large radiolucent area with indefinite outline, into which protrudes the root of the lateral incisor.

Operative Findings: A large cavity filled with granulation tissue and pus was found, the surrounding bone being of spongy character.

Figure 181.

Patient: Miss C. F. M.

History: Patient was suffering from infectious arthritis, most of the joints being involved and painful. She says that eight years ago an abscess was opened and scraped. The condition then became quiescent, but after two or three years a sinus formed on the gum, from which more or less pus has been discharged ever since, with occasional subacute attacks.

Roentgen Examination: Shows very large radiolucent area with well-defined outline, apparently starting from the devitalized lateral incisor.

Operative Findings: The bone cavity was filled with inflammatory granulation tissue, the walls being formed by cortical bone of good appearance.

Figure 182.

Patient: Mr. W.

History: The patient had a swelling of the gum over the lateral incisor several times with discharge of pus from a sinus.

Roentgen Examination: Shows a large radiolucent area originating around the devitalized lateral incisor.

Figure 183.

Patient: Mr. I. M. B.

History: Lateral incisor had been devitalized for a long time, discharging occasionally through a sinus, but without causing any disturbance.

Roentgen Examination: Shows large radiolucent area of irregular and undefined outline, the root apex being necrosed.

Operative Findings: The bone cavity was filled with granulation tissue, which was found to contain colonies of actinomyces.

Figure 184.

Patient: Mrs. W. P. L.

History: The right upper bicuspid had been extracted ten days before the picture was taken and in that time a growth formed from the wound, being very sensitive and bleeding easily.

Roentgen Examination: Shows two small radiopaque objects in the socket. It also shows the outline of the growth, which is more radiopaque than the other soft tissue.

Operative Findings: Cleaning out of the socket resulted in the discovery of two small sequestra, probably pieces of the alveolar process which had been fractured off. The growth was made up of granulation tissue.

FIGURE 180.

FIGURE 181.

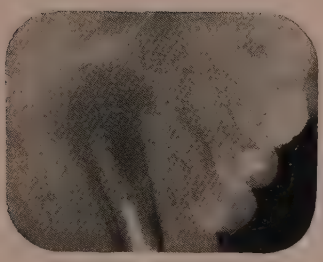

FIGURE 182.

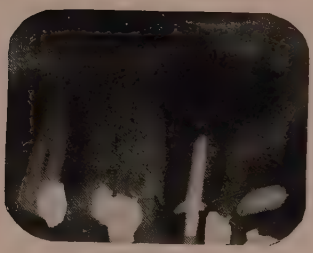

FIGURE 183.

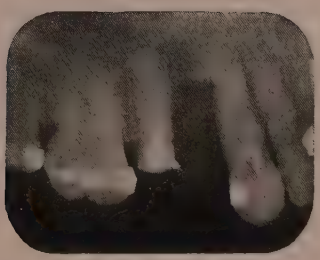

FIGURE 184.

Roentgenology of Necrosis of the Jaw

Figures 185 *and* 186.

Patient: Miss A. W.

History: Gum had been inflamed in front of upper jaw for a long time and was discharging pus from a sinus.

Roentgen Examination: A radiopaque object which, from its outline, may be taken for a front tooth is shown in the picture. In Figure 185 the soft tissues of the nose appear in the lower part. In Figure 186 the condition of the maxillary bone is shown and from the irregular, shaggy appearance we conclude that an extensive area is necrosed.

FIGURE 185.

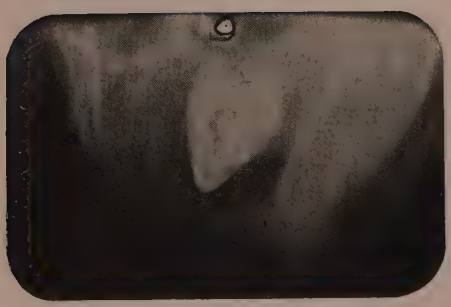

FIGURE 186.

Roentgenology of Dentigerous Cysts

Figures 187 *and* 188.

Patient: Mrs. H. H. P.

History: Upper cuspid has never erupted. The lateral incisor has been sore at times.

Roentgen Examination: Shows a radiopaque object which seems to be the missing tooth. Its cusp is in contact with the lateral incisor. Its root seems to extend into a radiolucent area of definite outline, which is probably a cyst.

Operative Findings: After extirpation of the tooth, a brownish liquid escaped from the wound. This was found to come from a cavity lined by a membrane. From this cyst cavity another opening was found, probably made accidently during the operation. This led into the maxillary sinus. Washing out of the sinus proved it to be in normal condition.

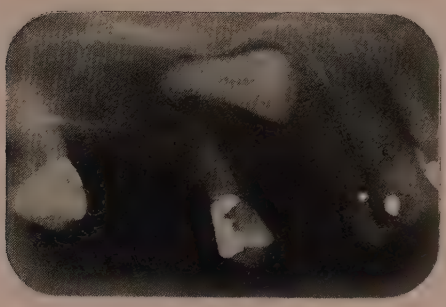

FIGURE 187.

FIGURE 188.

Roentgenology of Dentigerous Cysts

Figure 189.

Patient: Mr. Si.

History: Complained of bad-smelling fluid escaping from a sinus behind the lower second molar.

Roentgen Examination: An intraoral film showed a very radiolucent area behind the last erupted molar, but no impacted tooth could be discovered. An extraoral. plate was then taken, which showed a large radiolucent area surrounded by a light line. This is the typcal appearance of a cyst and it was found to contain the missing wisdom tooth at the lower border of the mandible.

Figure 190.

Patient: Boy, 15 years old. Courtesy of Dr. Halsy B. Loder.

History: First seen in September, 1915, when he had a swelling of the right side of the face. This was confined to the ascending ramus of the jaw. The gradual swelling had been noticed for nine months and was attributed to a blow. There had been slight pain.

Roentgen Examination: Courtesy of Dr. A. W. George. Shows a large dentigerous cyst, containing one well-formed tooth and a number of smaller foreign bodies, which have about the same radiopacity as the tooth.

Operative Findings: After exposing the ascending ramus of the jaw, which was hardly thicker than egg-shell, an area of this was removed and the cyst was dissected free from the bone. The cyst, itself, was thin-walled in its upper part and nearly $\frac{1}{2}$ inch thick in its lower part. In the course of the separation it was ruptured, and straw colored fluid escaped. This was removed, leaving a smooth-walled cavity in the bone.

Result of Operation: A Roentgenogram taken two months later showed that all foreign bodies had been removed.

Pathological Examination: Shows a cyst sac lined with epithelium and containing an adamantenoma.

FIGURE 189.

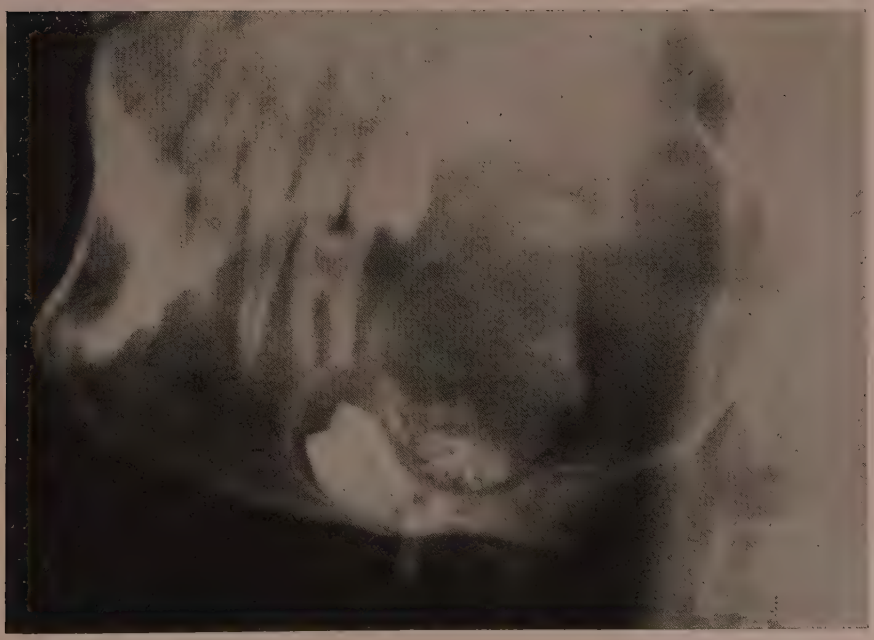

FIGURE 190.

Roentgenology of Simple and Multilocular Periodontal Cysts

Figure 191.

Patient: Mr. J. T. G.

History: Patient complained of tender place on outside of face which he noticed especially when shaving.

Roentgen Examination: Shows a large radiolucent area with well-defined outline. The lower first bicuspid is devitalized and is probably the cause of the cyst. Below the root apex of the second bicuspid note the picture of a smaller area, which is still more radiolucent.

Operative Findings: The cavity was filled with pus, containing cholesterin and lined by a membrane which was covered by epithelium. The cyst was located between the two bone plates, in the outer one of which there was a perforation, showing in the Roentgen picture as the smaller dark area under the second bicuspid. This is the place where the patient felt the tenderness.

Figure 192.

Patient: Miss E. R., courtesy of Dr. H. H. Germain.

History: Had swelling on lower jaw for several months (outer surface). Teeth had been treated without relief.

Roentgen Examination: Roentgen plate by courtesy of Dr. A. W. George. In the region of the mental foramen the mandible seems to contain several radiolucent places. These are separated by lamellæ of bone. The second bicuspid is apparently a vital tooth. From its apex the most prominent vertical septum starts and on each side of it there is a dark area indicating a cystic compartment. These may have been caused by granulomata on the roots of the first bicuspid and first molar, which had previously been extracted. The cuspid is also devitalized and seems to extend into the cyst.

Operative Findings: Cyst cavities filled with pus and granulation tissue.

FIGURE 191.

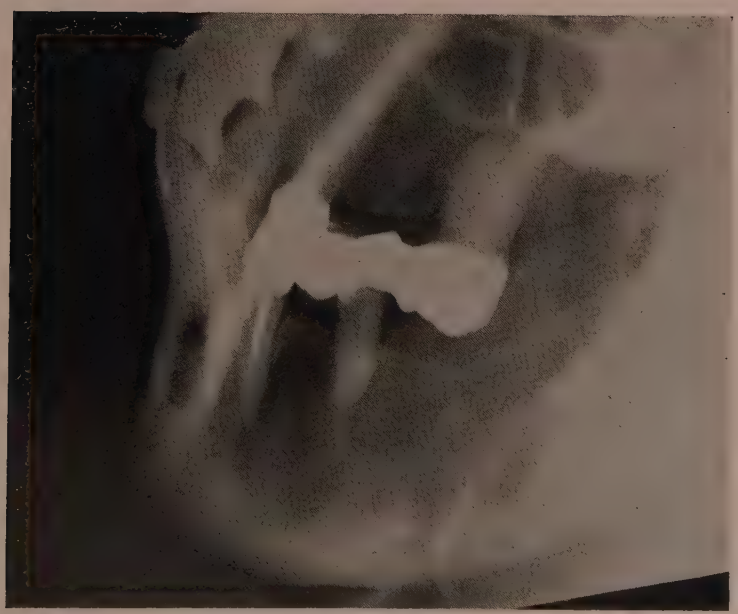

FIGURE 192.

Roentgenology of Periodontal Cysts

Figure 193.

Patient: Mr. J. C. F., courtesy of Dr. E. A. Locke, who referred the patient to the author.

History: Patient was unusually well until about a year before he was referred for examination of the mouth, when he broke down after a severe attack of grippe, the symptoms being principally those of nervous collapse. He was in the South for two months and then returned to work. Has been examined at Johns Hopkins University. Was obliged to give up work again and spend about six months in the mountains. While there he had some palpitation and dyspnoea and was evidently very anaemic. For some years he suffered from hemorrhoids and on Aug. 17, 1916, was operated on by Dr. T. Chittendon Hill. At this time the blood examination was as follows:

Haemoglobin	70%
Leucocytes	10,000
Red count	3,000,000

A smear showed a slight degree of achromia. On Aug. 28, the blood count was:

Haemogloblin	85%
Leucocytes	6,000
Red count	5,300,000

On September 18, 1916, the blood count was as follows:

Haemoglobin	85%
Leucocytes	7,000
Red count	5,120,000

The patient at this time had recovered from the operation entirely and seemed in much better health. The white count, however, seems to have increased again and the red count to have decreased. A Roentgen examination by Dr. George on Sept. 18 showed a large periodontal cyst of the jaw and abscesses about the roots of two more teeth. About 16 years ago the patient had an acute abscess on the left lower first molar, which had to be extracted.

Roentgen Examination: Shows a large radiolucent area in the mandible, all the teeth of this side being vital. A radiopaque object is seen in the middle of the cyst.

Operative Findings: After opening into the cyst, pus which was apparently under pressure escaped at once. The bone cavity was lined by the usual cyst sac and contained the apex of the first molar. It was evidently caused by the abscess which had occurred years before.

Result of Operation: The operation was performed by the author on Oct. 4, 1916, and on Oct. 11, 1916, Dr. Locke's report showed the following blood count.

Haemoglobin	92%
Red count	5,500,000

The patient was seen again eight months later, when he reported that he has been perfectly well ever since.

Figure 194.

Patient: Miss C. B. G.

History: Had suffered dull pain in lower jaw for seven years and complained of numbness in left side of lower lip and bad taste in mouth. Had a Roentgen examination at the Forsyth Dental Infirmary, but no cause was found.

Roentgen Examination: Shows a large radiolucent area in the ramus, surrounded by a light line. A very dark area is seen in the region of the post molar triangle.

Operative Findings: Opening of the cyst from the post molar triangle revealed a perforation of the bone, which appears in the Roentgen picture as a very dark area about the size of a pea. The bone over the post molar triangle was cut away and revealed a large cyst of the dimensions shown in the picture. The cyst sac communicated with the socket of the wisdom tooth and contained a great deal of pus and cholesterin.

FIGURE 193.

FIGURE 194.

Roentgenology of Periodontal Cysts

Figure 195.

Patient: Miss A. H. P.

History: Patient complained of poor health and was referred by her dentist for extraction of the left upper molars. During the extraction the antrum was opened into and a frontal Roentgen plate was taken immediately to ascertain the condition of the sinuses.

Roentgen Examination: On the left side the picture shows a radiopaque antrum, on the right side a radiopaque structure of definite shape with a well defined outline. The upper part of the antrum on this side is normal.

Operative Findings: The right maxillary sinus was found to be filled by a periodontal cyst, originating from abscessed teeth in the upper jaw. After the cyst membrane was removed the bone cavity was found to be whole and to contain no outlet into the nose. The left sinus was filled with polypoid growth.

FIGURE 195.

Roentgenology of Multilocular Cysts

Figures 196 *and* 197.

Patient: Mr. R. W., age 19 years. Courtesy of Dr. Samuel Mixter and Dr. G. D. Cutler.

History: When one year of age was hit hard on jaw with pump handle and was said to have fractured jaw at that time. Since then slow, continuous, painless growth went on, but the tumor was the present size ever since he could remember. About five weeks before being referred to Dr. Mixter he received an injury from a piece of ice striking his chin. One week later had pain and abscess formation, which broke and discharged foul pus and some blood, the discharge continuing through the sinus until the time of the present examination.

Examination: Well developed young man. Large, hard, irregular tumor found on lower jaw, mostly on right side, so firmly attached as to be continuous with the jaw bone. Skin of tumor not adherent, abnormal nor tender except at right corner of mouth, which was the site of the abscess.

Roentgen Examination: Roentgen plate by courtesy of Dr. L. B. Morison. Figures 196 and 197 are pictures taken at different angles. Note the large cyst cavities and their relation to the decayed teeth.

FIGURE 196.

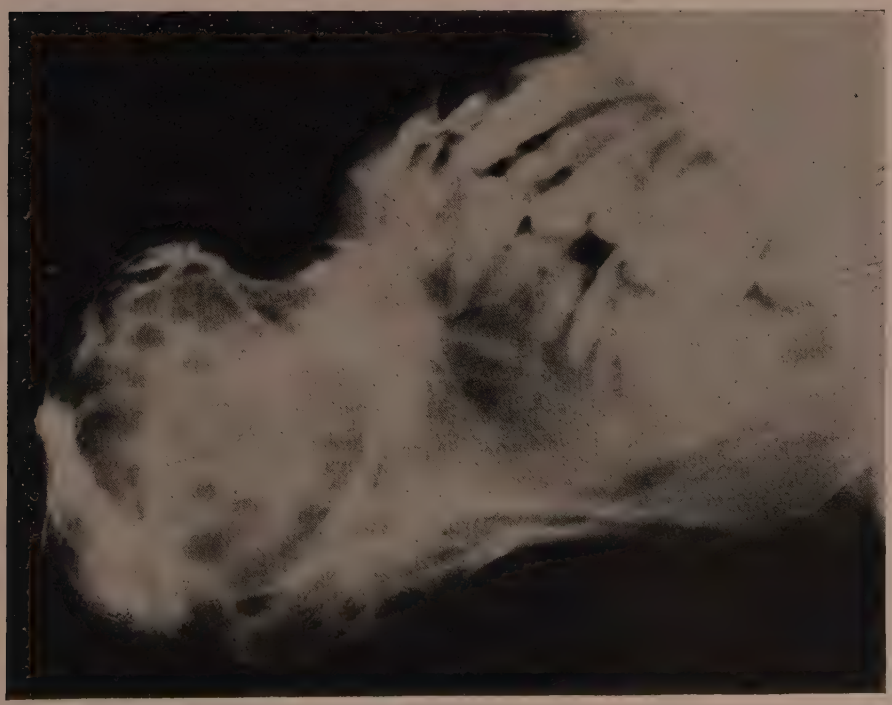

FIGURE 197.

Roentgenology of Carcinomata of the Jaws

Figure 198.

Patient: Courtesy of Dr. L. B. Morison.

History: The tumor started as an epithelioma of the lip. The metastatic processes of the carcinoma affected the jaw, as seen in the Roentgen picture.

Roentgen Examination: Plate by courtesy of Dr. L. B. Morison. The picture shows destruction of a large part of the mandible. Note the increase in the radiability of the part where the bone has been destroyed by the tumor.

FIGURE 198.

6. Diseases of the Air Sinuses

The accessory air sinuses of the nose are usually divided into an anterior group, made up of the frontal, ethmoidal and maxillary sinuses, which open into the middle meatus, and a posterior group, the posterior ethmoidal cells and the sphenoidal sinuses opening into the superior meatus of the nose. The inflammatory infections of all sinuses have features in common and frequently one becomes infected from the other. Diseased conditions can be diagnosed by means of the Roentgen ray.

Maxillary Sinusitis. Maxillary sinusitis in its acute suppurative or chronic form occurs much more frequently than is supposed. Evidence of sinus disease has been found in from thirty to fifty per cent of cases under post mortem observation.[1] While patients seek relief from the discharge of pus and other symptoms of acute inflammation, the chronic disease which manifests itself more indirectly by symptoms in the neighboring regions, the nose, pharynx, eyes, ears, teeth, head and face, or by interference with the general health, loss of weight, toxemia, mental depression, arthritis, or by other focal infections, is quite frequently overlooked.

Maxillary sinusitis may be caused from infections of either the nose or the teeth. According to Brophy, about seventy-five per cent of the cases are due to dental infection and usually they follow the occurrence of alveolar abscesses on the teeth which are related to the sinuses.

Roentgenographic examination is undoubtedly helpful in making a diagnosis of such conditions, but it should not be relied upon entirely. It is not easy to distinguish between acute and chronic maxillary sinusitis by means of the Roentgen method. An antrum filled with pus and affected by chronic inflammatory changes of the mucous membrane, with or without the formation of polypi, is less radiolucent and, therefore, has in a frontal plate a cloudy and lighter appearance than the healthy side. A lateral view shows the extent of the sinus and frequently also the neighboring teeth, but intraoral films give a clearer picture and will establish more definitely the dental cause, if present. They are, however,

[1] Harke, E. Fraenkel, Lappelle and Martin, quoted by F. Martin, De la Fréquence de l'Empyème, Bordeau, France, 1900.

of no value in diagnosing the condition of the antrum. When diseased antra are discovered one should always take films of the maxillary bicuspids and molars and, vice versa, when there are abscesses on those teeth which come close to the antra, the patient should be advised to have the sinuses Roentgenographed and transilluminated.

Roentgenology of Maxillary Sinusitis

Figures 199 *and* 200.

Patient: Mr. W. W. C.

History: Pain in zygomatic and infraorbital regions and discharge from right nostril. A frontal Roentgen plate shows radiopacity of the right antrum. The cause was ascertained by a film which showed radiolucent areas on two roots of the upper first molar, indicating abscesses.

Operative Findings: The antrum was found to be filled with polypoid growth and the bone over the molar was entirely necrosed.

FIGURE 199.

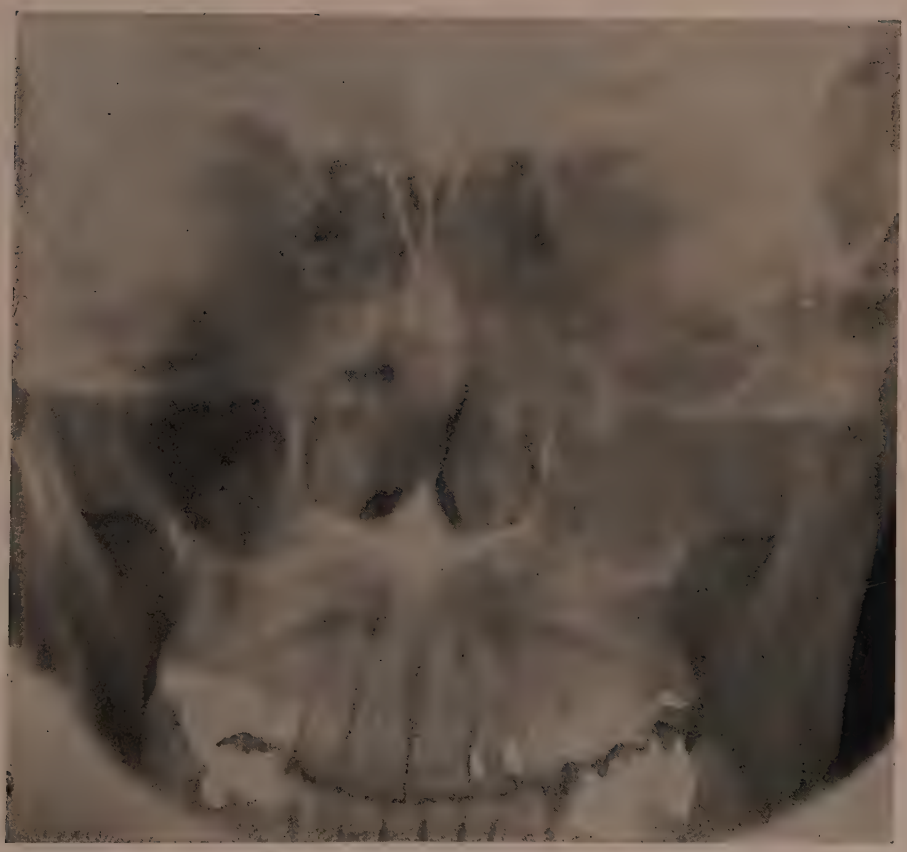

FIGURE 200.

Roentgenology of Teeth as Etiological Factors in Maxillary Sinusitis

Patient: Miss G. W. *Figure* 201.

History: Complains of bad taste in naso-pharynx, but no pain whatever.

Roentgen Examination: Intraoral films show many teeth with evidences of root canal work and radiolucent areas indicating abscesses extending to the maxillary sinus. A frontal plate shows radiopacity of the right antrum.

Operative Findings: Large necrosed areas in the upper jaw and the mucous membrane of the antrum covered with granulations.

Patient: Miss A. P. *Figure* 202.

History: Patient was in poor health and was referred by her dentist for extraction of the left upper molar. After extraction of the tooth a probe could be passed into the antrum, which was found to contain granulation tissue.

Roentgen Examination: The previously taken film showed a large radiolucent area on the root of the upper first molar, all three molars being devitalized. A frontal plate taken immediately after the extraction showed radiopacity of the left maxillary sinus and a cyst of the right sinus, described under Figure 195.

Patient: Mrs. R. H. *Figure* 203.

History: Patient complained of neuralgic pain on right side of face.

Roentgen Examination: Shows right upper second bicuspid and molar devitalized. These teeth are in close relation with the antrum.

Operative Findings: After the molar was extracted, a small amount of pus came from the antrum.

Patient: Miss F. E. M. *Figure* 204.

History: Patient had been feeling very badly for several months.

Roentgen Examination: Shows right upper third molar devitalized. Both molars enter into the maxillary sinus for quite a distance. A frontal plate showed radiopacity of the right antrum.

Patient: Mrs. F. K. *Figure* 205.

History: Complained of severe pain in head.

Roentgen Examination: Films of the teeth show several abscesses. The one on the palatal root of the first molar made involvment of the maxillary sinus seem possible. A frontal plate showed a radiopaque area in the lower part of the sinus.

Operative Findings: Upon opening the sinus, an abscess was found on the floor of the antrum over the region of the first molar.

Patient: Miss M. L. *Figure* 206.

History: Patient had been in a run-down condition for a considerable length of time. Had been under a physician's care, but did not improve.

Roentgen Examination: Shows indications of many pus pockets and abscesses in the right upper jaw. A frontal plate showed that the antrum was involved.

Result of Operation: After removing the teeth and treating the antrum, the patient improved rapidly.

Patient: Mrs. A. H. *Figure* 207.

Roentgen Examination: A film shows a radiolucent area around the roots of the upper first molar, which is fractured. Involvment of the antrum was suspected and ascertained by a frontal plate.

Patient: Mrs. H. K. *Figure* 208.

Roentgen Examination: Routine Roentgen examination shows many diseased roots in the upper jaw and radiopacity of the maxillary sinus.

Patient: Mr. D. G. *Figure* 209.

History: Five weeks before being referred to the author the patient began to have rheumatic swellings and pains in the knees. The shoulders were next attacked and in a short time all the large joints became involved. He took electric baths, but without success. When he came for examination of the mouth, he was walking with crutches and was in great pain, although he had no pain whatever in the face or mouth.

Roentgen Examination: Shows radiolucent areas indicating abscesses on an upper incisor and upper molar. The antrum was suspected and proved to be radiopaque.

Operative Findings: The antrum was opened and found to contain inflammatory granulation tissue, caused by the tooth which was extracted.

Result of Operation: Patient first suffered exacerbation due to the surgical autoinnoculation and had to stay in bed for a few days, not being able to use his joints. He then started to improve and after seven weeks was entirely rid of all his arthritic symptoms.

Patient: Mr. D. *Figure* 210.

History: During extraction of the first molar, which had been devitalized for a long time and, therefore, was very brittle, the palatal root was pressed into the maxillary sinus.

Roentgen Examination: Shows its position and thus aids its removal.

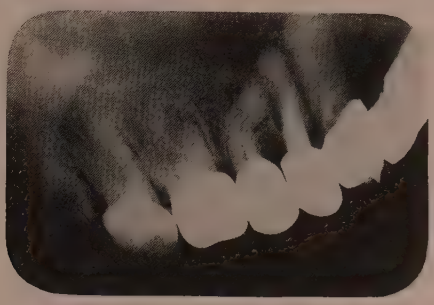

FIGURE 201.

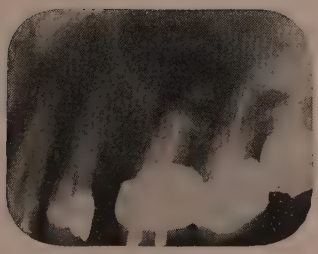

FIGURE 202.

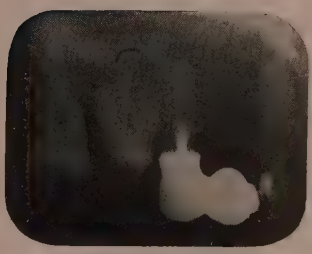

FIGURE 203.

FIGURE 204.

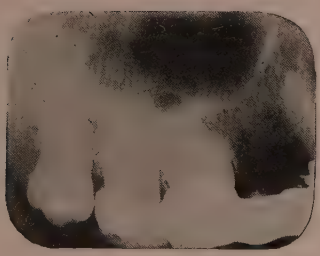

FIGURE 205.

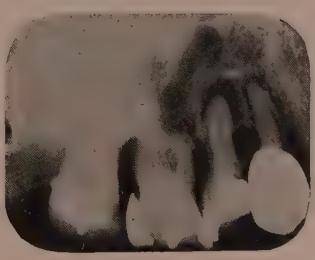

FIGURE 206.

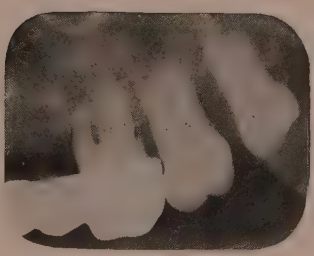

FIGURE 207.

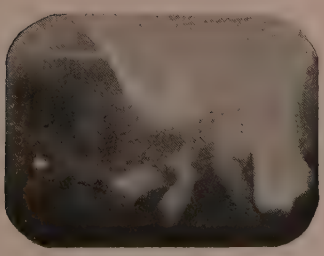

FIGURE 208.

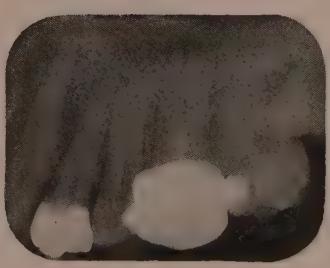

FIGURE 209.

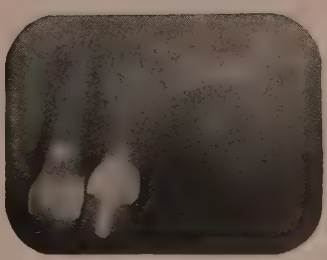

FIGURE 210.

7. Salivary Calculi

Calculi are most commonly found in the sublingual and submaxillary glands and ducts and are of rather rare occurrence in the parotid gland. It is not yet entirely settled whether the calculi are formed secondary to infection, calcium phosphate and carbonate being deposited concentrically around emboli, leucocytes or organic exudates, or whether the infection which usually accompanies such cases is due to the irritating presence of the calculi. A Roentgenogram of the inflamed or swollen floor of the mouth will not only show up the presence of a suspected calculus, but will also give some idea as to its location. The large intraoral film is the best one to use and should be placed between the teeth as far back as possible. The patient's head should be bent at an extreme backward angle so that the ray can be directed from the submandibular region on the film. If the calculus is in the submaxillary gland itself or in the parotid gland, an extraoral plate will give the most accurate information.

Roentgenology of Salivary Calculi

Figure 211.

Patient: Mrs. C. A. P.

History: Patient complained of swelling under the tongue which varied in size and was usually largest before meal times.

Roentgen Examination: Shows a radiopaque object on the right side of the floor of the mouth opposite the first molar.

Operative Findings: An incision was made in the mucous membrane of the floor of the mouth to expose the submaxillary duct and sublingual gland. The duct did not contain any foreign material, but the sublingual gland contained a salivary calculus surrounded by a small amount of pus.

FIGURE 211.

Roentgenology of Salivary Calculi

Figures 212 and 213.

Patient: Mrs. H. E. M., courtesy of Dr. John T. Bottomley.

History: Patient had tumor-like swelling on cheek and felt a hard substance under the skin, but no pain.

Roentgen Examination: Plates by courtesy of Dr. A. W. George. Two plates had to be taken to ascertain the location of the foreign bodies. From the lateral view, shown in Figure 212, one might think the radiopaque foreign bodies were located in the maxillary sinus, but the second plate shows that they are outside of the maxillary bone and from the location in both plates, we may conclude that they are in the parotid gland.

Operative Findings: The foreign bodies, after being removed, were found to be small lumps and felt like cartilage. Pathological examination showed them to be organized thrombi, which had become calcified. These phleboliths showed concentric arrangement.

FIGURE 212.

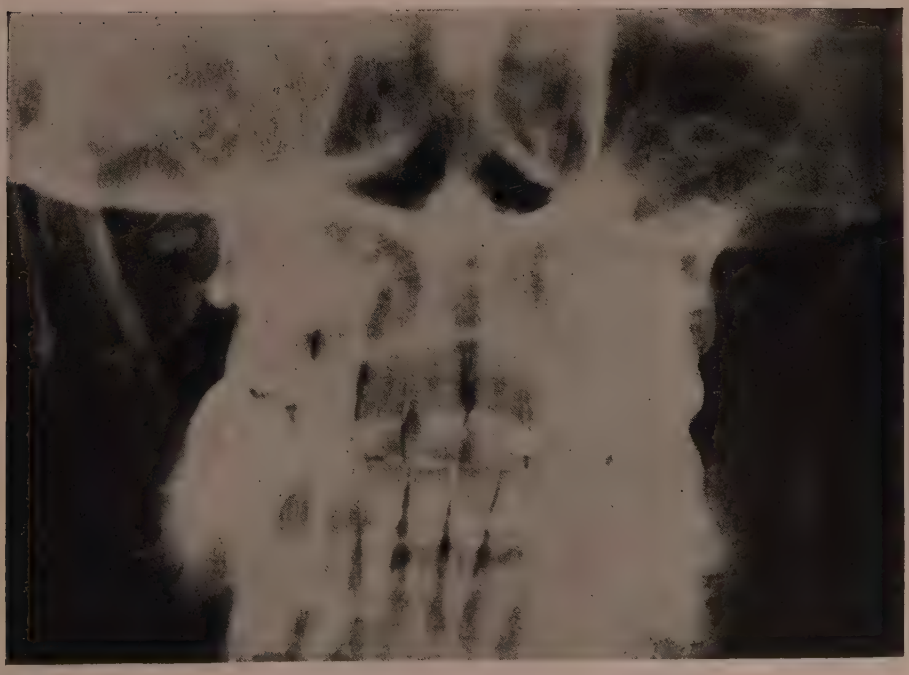

FIGURE 213.

PART III

THE USE OF ROENTGENOGRAMS AS AN AID IN TREATMENT AND TO RECORD THE PROGRESS OF HEALING

WHILE the Roentgen ray is of inestimable value in the diagnosis of abnormal and diseased conditions, it is almost indispensable as an aid in certain therapeutic processes such as root canal work, apicoectomy, the setting of fractured jaws, etc. It is a great help to have a Roentgenogram before any treatment is started, as a correct diagnosis is the first step in determining the necessary therapeutic method and often saves the patient a great deal of time and annoyance. The progress of treatment can be followed step by step and the final result of mechanical procedures can thus be ascertained. To follow the process of healing is not only of interest to all concerned, but is of great scientific value for reports and for showing the success of newly developed methods and surgical procedures.

1. The Treatment of Root Canals

Root canal treatment and filling has been the greatest short coming in dentistry, principally because without a Roentgenogram the dentist works in the dark, trying to treat a condition which has not been properly diagnosed. If we know the proper size, length and direction of the root canals and their abnormal conditions, we can more easily accomplish the desired result. Poor root canal fillings are found in the mouths of almost every patient (see Figures 214–222).

Prognostic Roentgen Examination before Removing Pulps from Vital Teeth. Our knowledge of the etiology and complications of alveolar abscesses and realization of the uncertainty of root canal fillings should impress on our minds the seriousness of pulp extirpation. He who extirpates the pulp of one or more teeth to restore masticating efficiency by bridge work renders poor service if blind abscesses develop on the de-

vitalized teeth, endangering the patient's health. A pulp should not be sacrificed except after most careful consideration and prognostic study of the roots and root canals by means of Roentgenograms. The Roentgen picture may show normal canals, open apical foramina, accessory foramina, bent and curved roots, canals made inaccessible by secondary dentine, and pulp stones (see Figures 92–98).

Prognostic Roentgen Examination of Previously Treated Pulps and Pulps which are to be Treated. It is of great importance to make sure of the probable outcome before involving the patient in lengthy root canal treatment and before using devitalized teeth as abutments for expensive prosthetic appliances. If the Roentgenogram shows no extensive involvment of the periapical tissue, the condition can usually be kept within normal bounds if the root canal is treated and filled to the apex. Small blind abscesses or granulomata of short duration will disappear after ionic medication, but if broken root canal instruments are discovered, if there is indication of extensive bone destruction due to an abscess or granuloma, if the apex is found to be necrosed, or if the side of the root has been perforated, the tooth, as a rule, cannot be restored to normal by root canal treatment alone. It should either be extracted or receive surgical treatment directed towards the periapical disease, the operation being called apicoectomy or root amputation.

The Use of the Roentgen Ray as a Guide in Root Canal Cleaning and Filling. The importance of the removal of every particle of pulp tissue, whether healthy or diseased, from the canal or canals of a tooth has only recently been fully realized. It is also imperative for the canal to be properly reamed and enlarged, either by mechanical or chemical means, and for the apical foramina to be hermetically sealed by means of suitable root canal fillings. The only safe way to determine whether a canal is properly prepared for successful filling is by means of the Roentgen ray. If the operator has a Roentgen machine by his chair, he can insert broaches of the right size and take a picture with a rubber dam in place. The rubber dam clamps, however, should be removed and replaced by ligatures so as not to confuse the picture. If the film is to be taken at some future time or in a different place, fine wires with looped ends and containing the antiseptic dressing should be inserted into the canals, after which the cavity should be sealed. This process ought to be repeated until the Roentgen picture

shows that the wire extends to the very end of the root. After the root canal is filled, another Roentgenogram should be taken and, in case the filling does not reach the apex of the root, or each of the roots, it should be removed and replaced by a perfect one (see Figures 233–250).

2. Apicoectomy

Prognostic Roentgen Examination. Before undertaking apicoectomy on a tooth, the condition should be carefully studied. Observe the shape of the root and the extent of the abscess towards the cervical margin. If too much of the root has to be excised, there will not be enough alveolar process left to hold it firmly after the operation. A tooth with pyorrhea or marginal pus pockets is for the same reason not a favorable case. Neither should a tooth be operated on if there is another abscess close to it, as this would directly or indirectly reinfect the healing tissue.

Checking Up of the Different Steps. Proper root canal treatment is the first step in apicoectomy. The operation can only be successful if future infection is prevented by sterilization of the root canal and dentinal tubules. Roentgenograms are used in the manner described for root canal treatment to check up the different steps. The final one, showing the extent of the root canal filling, gives us also an idea of the length of the root, the position of the neighboring teeth and the extent of the abscess.

Following Up the Healing Process. The author takes a Roentgen picture immediately after the operating, to make sure of the result of the operation. Successive pictures, taken every six months, show the filling in of bone tissue, the process usually being completed in from one to two years, according to the size of the bone cavity and the age of the patient.

3. Prosthetic Dentistry and Orthodontia

Conditions of Roots Used for Prosthetic Abutments. It has already been pointed out that it is well to Roentgenograph a tooth or root before considering its use as an abutment. Much time and annoyance may be saved by finding out whether the periapical tissue is involved, whether the root end is healthy or necrosed and whether the canals can be properly treated and filled. It is not sufficient to be contented if a tooth is strong and firm or if it gives no discomfort. Neither is it justifiable to nurse along diseased roots, simply because they are the means of supplying

and attaching profitable crown and bridge work. The patient's health should not be jeopardized for the sake of convenience or appearance. To-day it is the moral duty of every dentist to make sure, by means of the Roentgen ray, that a devitalized tooth is healthy and surrounded by healthy bone before he makes use of it for a bridge abutment (see Figures 223–227).

Unerupted Teeth and Broken-off Roots. If a tooth which has never erupted is to be replaced, the first thing to be decided is whether it is concealed somewhere in the jaw as an unerupted, impacted tooth. Frequently unerupted teeth start growing if stimulated by the pressure of prosthetic appliances. The author once saw a case where an unerupted cuspid pushed the Richmond crown of a bridge from the root. If the gum has an inflamed or suspicious appearance, a Roentgen picture should be taken to find out if there are broken-off roots irritating the tissue (see Figures 288–294).

Orthodontic Treatment of Unerupted or Partially Impacted Teeth. Cuspids are frequently found in a position from which they cannot right themselves, but by orthodontic means they can be slowly pulled into place. Roentgen pictures serve as a means of finding out whether the tooth is hopelessly impacted and has to be removed, or whether there is a chance of getting it into position after the bone and soft tissue have been cleared out of the way by surgical means (see Figures 297–301).

4. Treatment of Fractured Jaws

The locating of fractures by means of the Roentgen method has already been described. Although we can very often judge the result of setting the bones by the occlusion of the teeth, it is always well to take a Roentgenogram and make sure that the best result has been accomplished. If the healing does not progress as expected in a compound fracture, one can often locate, by means of the Roentgen method, sequestra or parts of teeth which have been lost in the wound.

5. The Healing of the Jaws after Operative Interference

The Removal of Foreign Bodies and Odontomata. If foreign bodies are located in a jaw or odontomata found by the Roentgen method, it is always well to take another Roentgen plate after the operation to ascertain whether the removal has been properly accomplished. The advantage

of this is illustrated in the case shown in Figures 202 and 203. Some of the small particles might easily have been overlooked during the operation.

The Healing of the Jaws after Bone Operations. It is not only interesting and scientifically valuable to follow the healing of the bone after extensive operations, but it is sometimes of clinical importance. In the case of osteomyelitis, described on page 126–128, many small sequestra could be located at different periods of the healing process. The knowledge of their exact location facilitated their removal greatly. Some of the later pictures from this case are shown in Figures 304–309.

Roentgenograms of Previously Treated Pulps

Figures 214–222.

Roentgen Examination: The teeth in all of these pictures show root canals which have been only partly filled and, in many cases, not properly condensed. Note also how the periapical tissues have been affected.

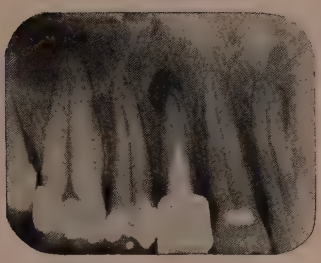

FIGURE 214.

FIGURE 215.

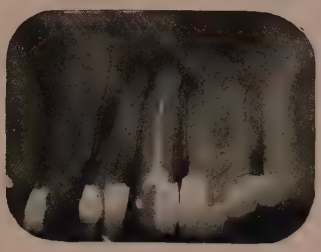

FIGURE 216.

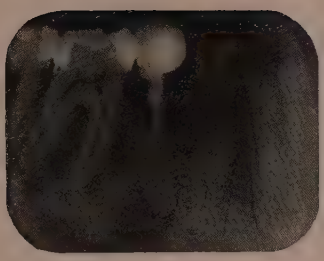

FIGURE 217.

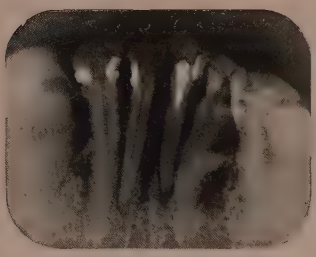

FIGURE 218.

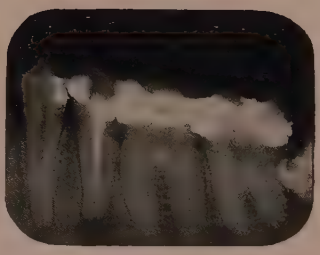

FIGURE 219.

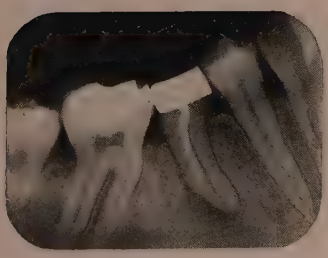

FIGURE 220.

FIGURE 221.

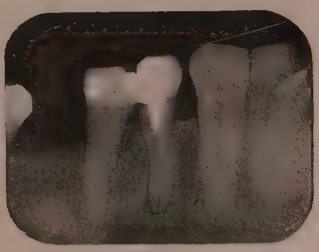

FIGURE 222.

Roentgenograms of Teeth Used as Bridge Abutments

Figures 223–227.

Patient: Mr. W.

History: All the bridge work shown in the illustrations had been in the patient's mouth only a very short time.

Roentgen Examination: Shows radiolucent areas on many of the teeth indicating abscesses, which existed at the time the root canals were filled, or resulted from poor root canal work done later.

FIGURE 223.

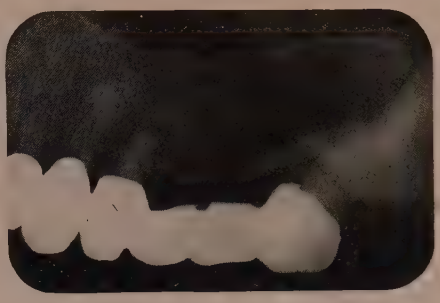

FIGURE 224.

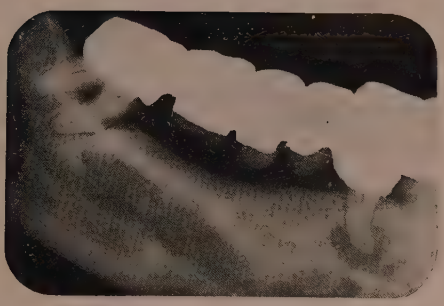

FIGURE 225.

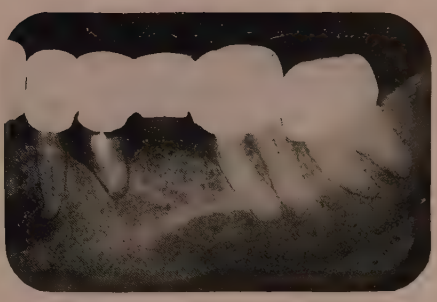

FIGURE 226.

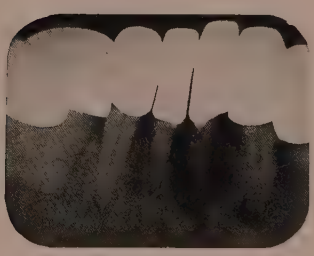

FIGURE 227.

Roentgenograms Showing Broken Root Canal Instruments

Figure 228.

The radiopaque object in the root canal of the upper first bicuspid was found to be a piece of a broach.

Figure 229.

The radiopaque object in the distal root canal of the first molar was found to be the point of a root canal drill.

Figure 230.

In the apex of the lateral incisor there is a small radiopaque object which appears much lighter than the root canal filling.

Roentgenograms Showing Root Perforations

Figure 231.

The cuspid shows the root canal filling in the proper place, but the post of the porcelain crown protrudes on the side of the crown. Note the radiolucent area representing the lateral granuloma.

Figure 232.

The root of the first bicuspid has been perforated at the mesial side and the filling protrudes into the alveolar bone.

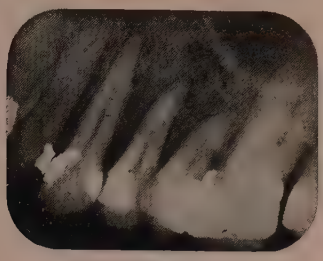

FIGURE 228.

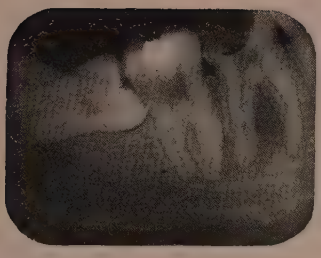

FIGURE 229.

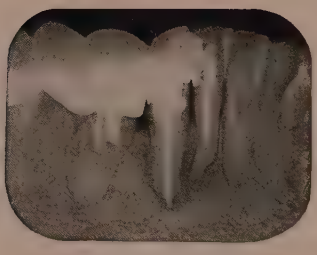

FIGURE 230.

FIGURE 231.

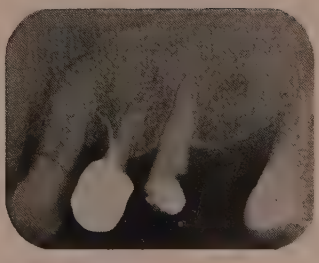

FIGURE 232.

Roentgenograms Used as an Aid in Root Canal Cleaning and Filling

Figures 233–235.

Figure 233 shows poor root canal filling.

Figure 234 shows wire inserted to indicate the distance cleaned out.

Figure 235 shows new filling.

Figures 236–240.

Figure 236 shows lower first molar. Note the change in the bone surrounding the apices. This, being pathological, leads to the conclusion that the pulp is infected.

Figure 237 was taken with a rubber dam ligated into place and a broach inserted into the distal canal.

Figure 238 shows broaches in the two canals of the mesial root, indicating that the end has almost been reached.

Figure 239 shows three broaches inserted in the canals of the molar. These extend to the very ends.

Figure 240 shows the completed root canal fillings.

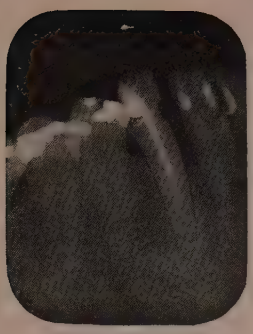

FIGURE 233.

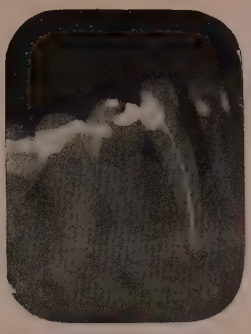

FIGURE 234.

FIGURE 235.

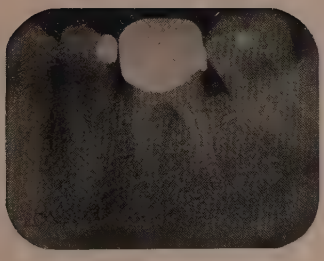

FIGURE 236.

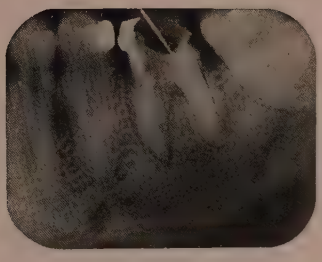

FIGURE 237.

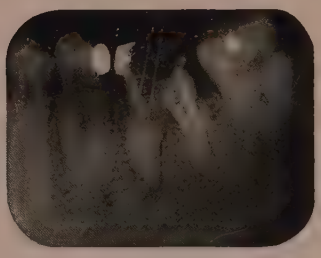

FIGURE 238.

FIGURE 239.

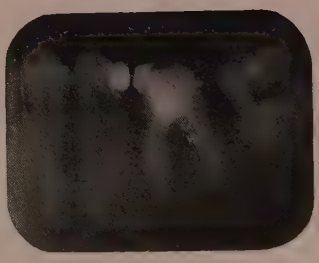

FIGURE 240.

Roentgenograms as an Aid in Root Canal Filling

Figures 241–243.

Figure 241 shows lateral incisor and cuspid with poor root canal fillings.

Figure 242 shows wires inserted indicating that the ends of the canals have been reached.

Figure 243 shows new root canal fillings.

Figures 244–250.

Figure 244 shows the root canal properly filled with a small excess of chloropercha, which went through the apical foramen.

Figure 245 shows a root canal filling previous to apicoectomy. Chloropercha was pressed through the foramen into the granuloma.

Figure 246 shows the root canal filling of an upper central incisor. Note the accessory canal and the excess of gutta percha beyond both apical foramina.

Figure 247 shows the root canal filling of an upper lateral incisor.

Figure 248 shows the corkscrew variety of root canal filling in a lower bicuspid.

Figure 249 shows the filling replaced with a small excess of soft chloropercha outside of the foramen.

Figure 250 shows the root canal filling of an upper cuspid, the apex being very close to the antrum.

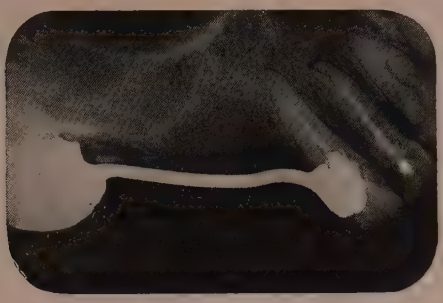

FIGURE 241.

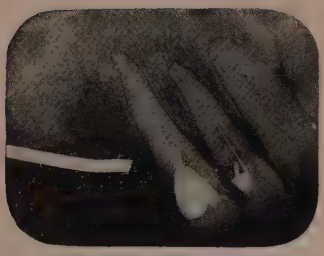

FIGURE 242.

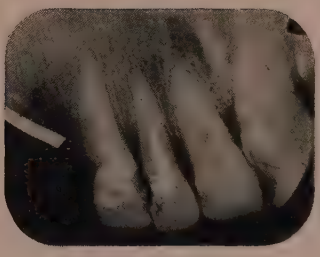

FIGURE 243.

FIGURE 244.

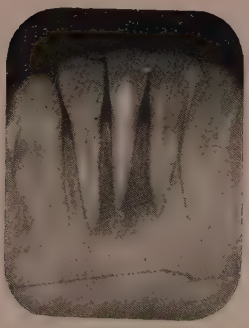

FIGURE 245.

FIGURE 246.

FIGURE 247.

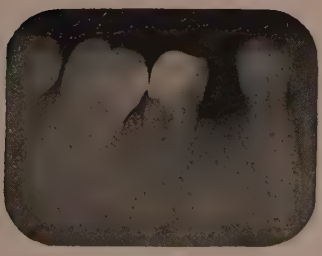

FIGURE 248.

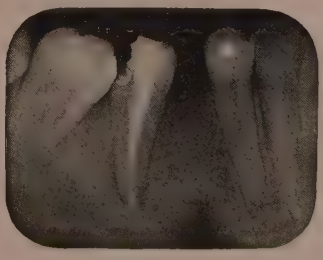

FIGURE 249.

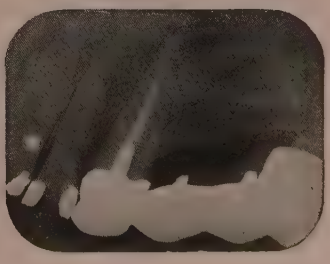

FIGURE 250.

Roentgenograms of Teeth not Suitable for Apicoectomy

Figures 251–253.

Figure 251 shows the radiolucent area extending almost to the cervical margin of the alveolar process.

Figure 252 shows a very short root, entirely surrounded by a radiolucent area.

Figure 253 shows almost the entire alveolar socket involved by an abscess area.

Roentgenograms Showing Apicoectomy

Figures 254–257.

Figure 254 shows the condition before the operation.

Figure 255 shows wires in the root canals to indicate the extent to which they have been cleaned.

Figure 256 shows the new fillings in the root canals.

Figure 257 shows the condition after apicoectomy has been performed.

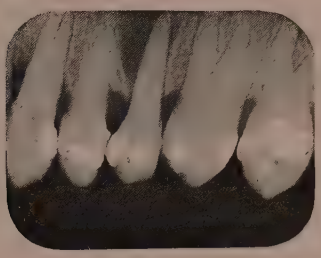

FIGURE 251.

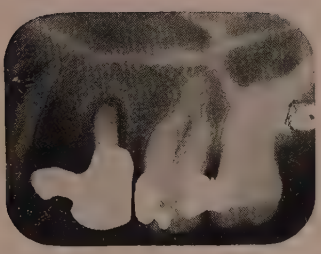

FIGURE 252.

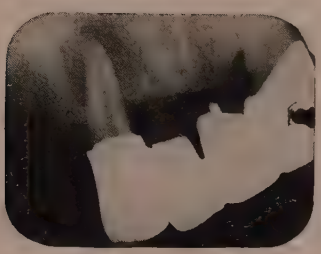

FIGURE 253.

FIGURE 254.

FIGURE 255.

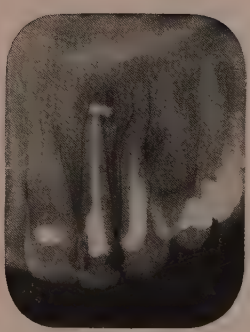

FIGURE 256.

FIGURE 257.

Roentgenograms Showing Apicoectomy

Figures 258–262.

Figure 258 shows the condition before treatment.

Figure 259 shows a wire in the cuspid.

Figure 260 shows the root canal filling completed in the cuspid and second bicuspid, the first bicuspid having been extracted because the root canals could not be opened properly.

Figure 261 shows the bridge cemented in place.

Figure 262 shows the condition after apicoectomy has been performed on both teeth.

Figures 263–266.

Figure 263 shows the condition after apicoectomy has been performed on a lower central incisor.

Figure 264 shows the condition after apicoectomy has been performed on both lower central incisors.

Figure 265 shows the condition before apicoectomy was performed. Note the broken root canal instrument and the bent root of the lateral incisor.

Figure 266 shows the condition after the operation.

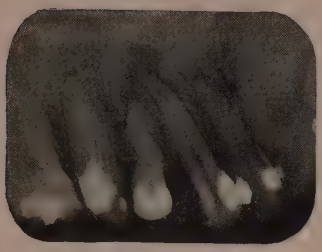

FIGURE 258.

FIGURE 259.

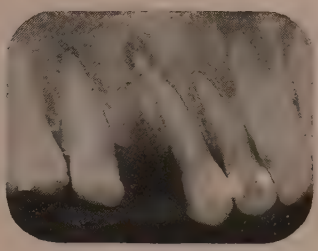

FIGURE 260.

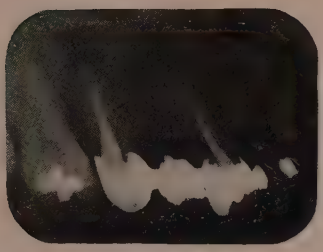

FIGURE 261.

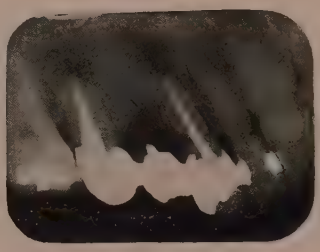

FIGURE 262.

FIGURE 263.

FIGURE 264.

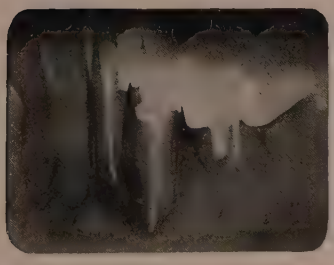

FIGURE 265.

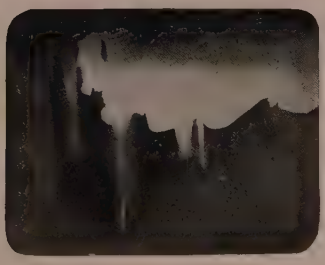

FIGURE 266.

Roentgenograms Showing Healing after Apicoectomy

Figures 267–270.

Figure 267 shows an abscess caused by a dead pulp.

Figure 268 shows the root canal treated and filled.

Figure 269 shows the condition after apicoectomy was performed.

Figure 270 shows the progress of the healing after eight months.

Figures 271–274.

Figure 271 shows the root canal filling and condition of periapical tissues before the operation.

Figure 272 shows the condition after treatment and filling of the root canal.

Figure 273 shows the condition after the operation.

Figure 274 shows new bone formation nine months after the operation.

FIGURE 267.

FIGURE 268.

FIGURE 269.

FIGURE 270.

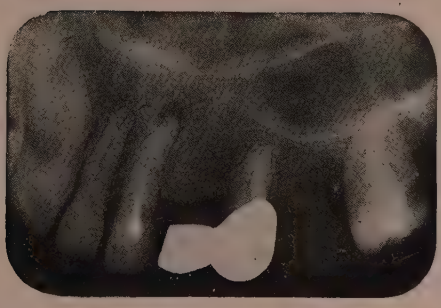

FIGURE 271.

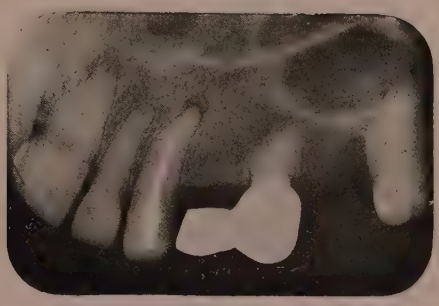

FIGURE 272.

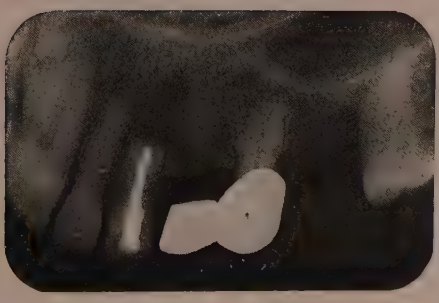

FIGURE 273.

FIGURE 274.

Roentgenograms Showing Healing after Apicoectomy

Figures 275–278.

Figure 275 shows condition immediately after apicoectomy was performed on the upper lateral and central incisors.

Figure 276 shows progress of the healing after two months.

Figure 277 shows progress of the healing after ten months.

Figure 278 shows the bony wound entirely filled in after two years.

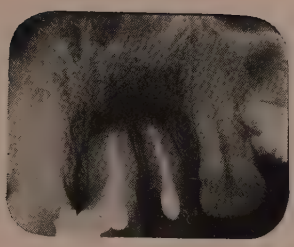

FIGURE 275.

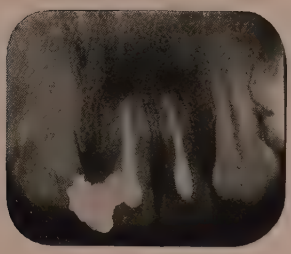

FIGURE 276.

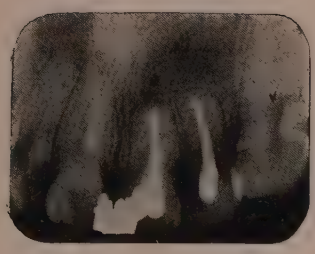

FIGURE 277.

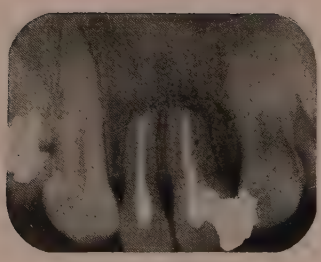

FIGURE 278.

Roentgenograms Showing Healing after Apicoectomy

Figures 279–281.

Figure 279 shows root canal filled, apparently by the old method, the points not having been dissolved in chloroform and resin placed in the canal.

Figure 280 shows the condition after the operation.

Figure 281 shows the bony wound entirely filled in, after fourteen months.

Figures 282–286.

Figure 282 shows a wire in the canal indicating the extent to which it has been cleaned out.

Figure 283 shows the canal after the filling has been put in.

Figure 284 shows the crown cemented into place.

Figure 285 shows the condition two months after the operation, the bone having started to fill in.

Figure 286 shows the healing of the bone cavity fourteen months after the operation.

FIGURE 279.

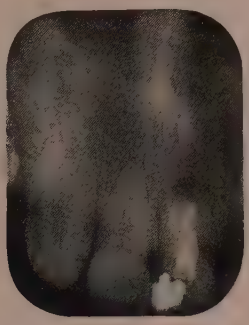

FIGURE 280.

FIGURE 281.

FIGURE 282.

FIGURE 283.

FIGURE 284.

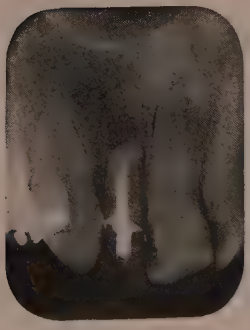

FIGURE 285.

FIGURE 286.

Roentgenograms in Prosthetic Dentistry

Figure 287.

Patient: Miss N.

History: Had feeling of pressure in left upper side of jaw, the lateral incisor being very sore. Shortly before the Roentgen examination she had a bridge made to replace the missing cuspid. No Roentgenogram was taken at that time. She consulted a dentist, who advised removing the pulp of the lateral incisor or taking off of bridge.

Roentgen Examination: Shows both bicuspids and the lateral incisor vital; also an unerupted cuspid causing pressure on the root of the lateral incisor.

Figure 288.

Patient: Mr. I. V. W.

History: Complained of occasional soreness of the central incisor.

Roentgen Examination: Shows impacted and unerupted cuspid.

Figure 289.

Patient: Mr. H. W. L.

History: Pus discharge from under the bridge and slight swelling of the gums.

Roentgen Examination: Shows unerupted cuspid, which apparently has become infected by the abscess condition on the lateral incisor.

Figure 290.

Patient: Mr. H. P. H.

Roentgen Examination: Shows a piece of root under the bridge. Note also the radiolucent area around the biscupid.

Figure 291.

Patient: Mr. C. G. C.

History: Had all his teeth extracted in the lower jaw and a plate made. This caused inflammation and pus discharge from an opening in the right lower side.

Roentgen Examination: Shows an unerupted lower third molar which had escaped notice, as no Roentgen pictures were taken at the time of the extraction. The radiolucent area surrounding it shows the infection of the bone.

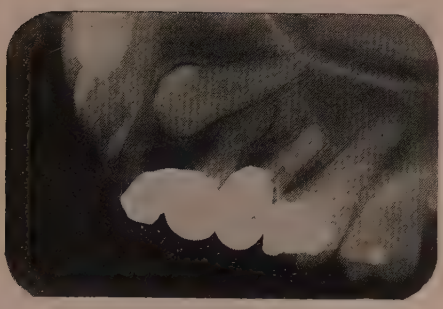

FIGURE 287.

FIGURE 288.

FIGURE 289.

FIGURE 290.

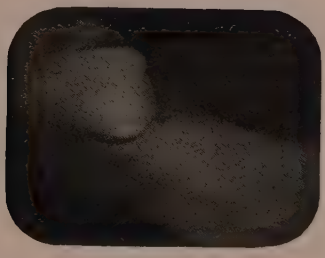

FIGURE 291.

Roentgenograms in Prosthetic Dentistry

Figure 292.

Patient: Mr. H. K. B.

History: Inflammation of gum under the bridge and sinus, from which there was discharge of pus.

Roentgen Examination: Shows two roots and large radiolucent areas, beneath the bridge.

Figure 293.

Patient: Mr. P.

History: Swelling on gum.

Roentgen Examination: Shows two infected roots under the bridge.

Figures 294–296.

Patient: Mr. R. S. C.

History: Patient was hit with a hockey stick, fracturing the central incisor (see Figure 294), and two fragments of the tooth were removed (see Figure 295). By means of the Roentgen picture a dummy was carved with a root to fit exactly into the socket. It was attached by means of a staple crown to the other central incisor (see Figure 296).

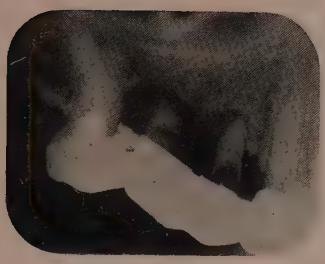

FIGURE 292.

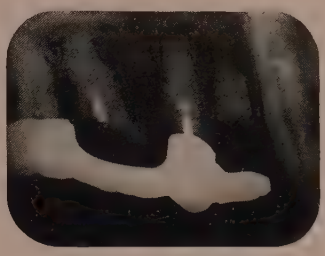

FIGURE 293.

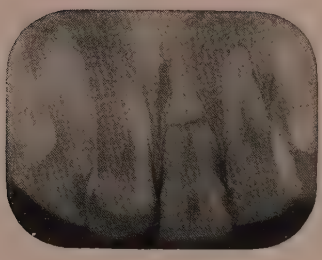

FIGURE 294.

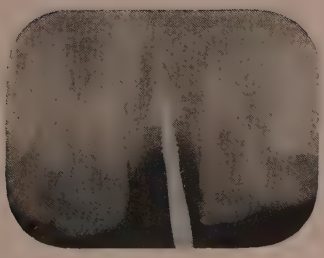

FIGURE 295.

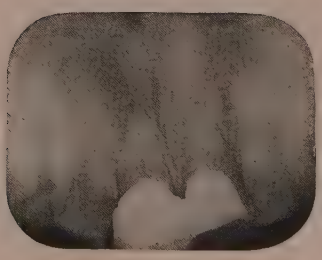

FIGURE 296.

Roentgenograms in Orthodontia

Figure 297.

Patient: Mr. C.

Roentgen Examination: This is a case of orthodontia. The cuspid was missing and its location was ascertained to find out the possibility of drawing it into place.

Figures 298–301.

Patient: Mr. F.

History: Some of the temporary molars are still in place, with no sign of the permanent bicuspids coming.

Roentgen Examination: In the upper jaw there is no evidence of the bicuspids and the left upper cuspid is growing in an oblique direction. In the lower jaw both first bicuspids are partially erupted, but the second bicuspids are missing. Note that the roots of the temporary molars have been absorbed, although the permanent teeth are absent.

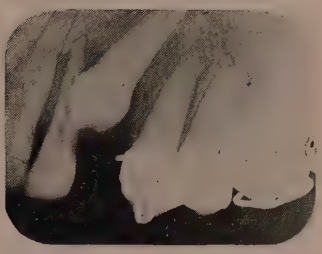

FIGURE 297.

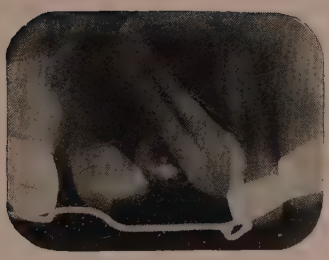

FIGURE 298.

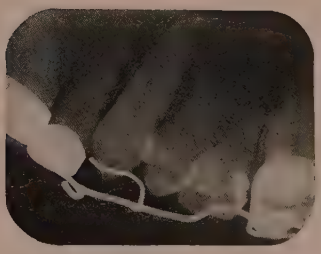

FIGURE 299.

FIGURE 300.

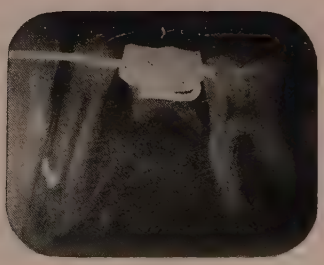

FIGURE 301.

Roentgenograms Showing Results of Operations

Figures 302–303.

Figure 302 shows a Roentgenogram of a follicular cyst containing many incompletely formed teeth.

Figure 303 shows a second Roentgen picture taken after the operation, establishing the fact that all the particles have been removed.

FIGURE 302.

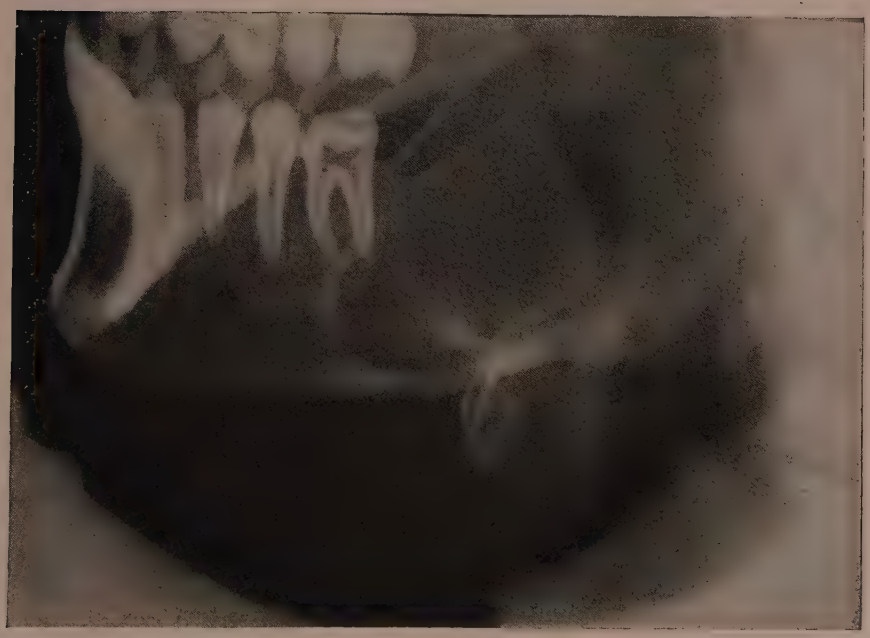

FIGURE 303.

Roentgenograms Showing the Process of Healing of Bone

Figures 304–305.

Figure 304 shows a case of osteomyelitis of the mandible, described on page 126.

Figure 305 shows a Roentgen picture taken eight months later, the bone having healed entirely except in one or two places. Note the mental foramen, which is radiolucent and a small radiopaque sequestrum surrounded by a radiolucent area of inflammatory granulation tissue.

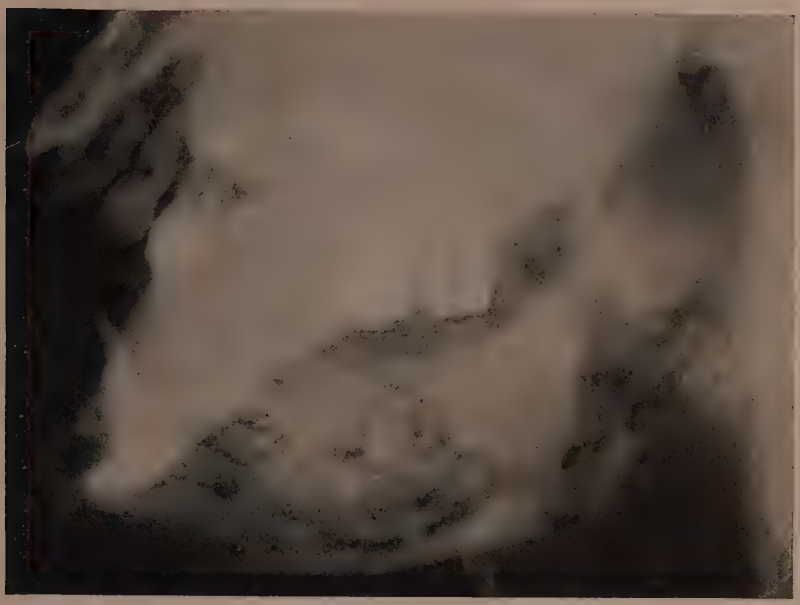

FIGURE 304.

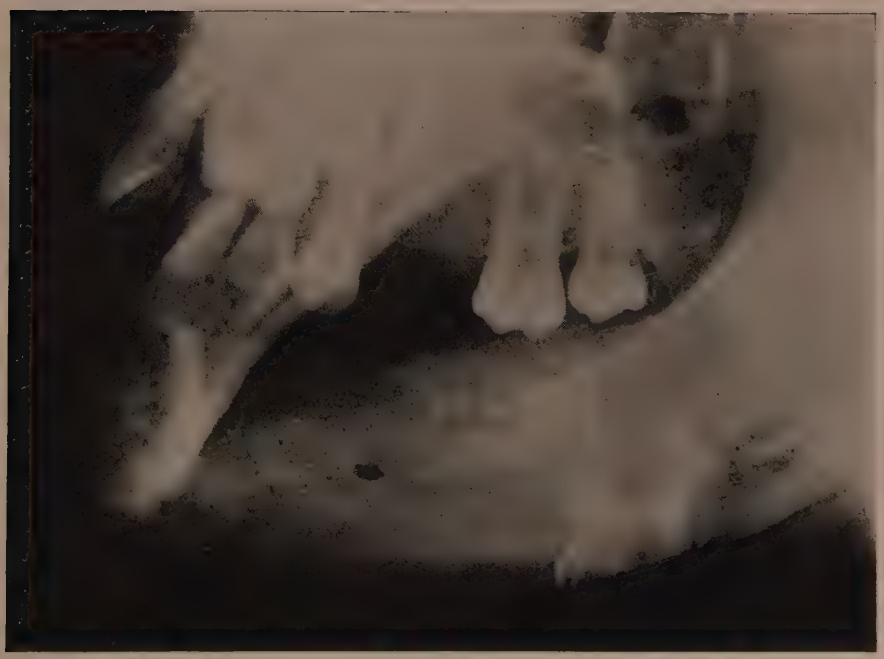

FIGURE 305.

Roentgenograms Showing Healing Process of Bone

Figures 306–307.

Figure 306 shows a Roentgen picture of the other side in the case of osteomyelitis of the mandible, reported on page 126, taken before the operation.

Figure 307 shows complete healing on this side after a period of ten months.

FIGURE 306.

FIGURE 307.

Roentgenograms Showing Healing of Bone

Figures 308–309.

Figure 308 shows a Roentgen picture of a case of a periodontal cyst of the mandible described on page 140.

Figure 309 shows a Roentgen picture taken eight months later, showing how the bone has grown into the cavity.

FIGURE 308.

FIGURE 309.

PART IV

ROENTGENOGRAPHIC EXAMINATION OF THE ORAL TISSUES IN SOMATIC DISEASES

THE important discovery that oral lesions may be the cause of various somatic diseases has brought about great changes in the practice of dentistry. The man who previously thought his only duty was mechanically to repair diseased or lost dental tissue is now impelled, if he is sincerely interested in the health of his patient and the development of his profession, to a deeper study of the pathology of the mouth.[1]

Oral Lesions as the Primary Cause of Systemic Disease. The physician has for a long time realized that infections may be transported from foci in the nose, throat, intestinal tract and genito-urinary system. The lesions of the teeth and jaws are only a newly recognized etiological factor in cases of some systemic diseases.

Secondary Lesions. Infectious processes of the jaws may spread and involve neighboring parts, causing osteomyelitis, necrosis of the jaws, maxillary sinusitis and periodontal cysts, which may grow to tremendous size and often contain a great deal of pus. Such secondary lesions may in turn become foci of systemic diseases.

Discharge of Pus into the Mouth. Abscesses with sinuses, pyorrhea pockets and suppurating surface lesions of the mouth discharge pus and bacteria into the oral cavity, where it is mixed and swallowed with the saliva and food. Frequently such conditions cause infections of the throat and tonsils, as well as gastric and intestinal disorders.

Absorption through the Lymphatic Channels. The lymphatic system and especially the lymph glands have the office to absorb and dispose of harmful substances, such as are liberated in all inflammatory conditions. A certain amount of pus may, however, reach the circulation via the lymph system, while not infrequently we find the lymphatics or the glands seriously affected. Tubercular infection of the submaxillary lymph glands, independent of general tuberculosis, often spreads through

[1] Thoma, K. H. Oral Abscesses.

these channels. Fifty clinical observations have been reported by Professor Cantani of Naples.[1]

Absorption through the Blood Channels. Haematogenous infection is the most important way by which the disease may be transported from the original focus to other parts of the body. Bacteria, or the poisons produced by bacterial activity, or both, may be taken up by the blood stream and cause various secondary disturbances. The streptococcus has been isolated from joints and the staphylococcus has also been experimented with and found to cause joint lesions in rabbits when injected intravenously. One or both of these bacteria are almost always found in tooth abscesses, together with a large variety of other microörganisms, saprophytes and anaerobes of all kinds, which split the necrosed tissue into complicated by-products, frequently strong protein poisons. In opening an abscessed tooth, such by-products can very frequently be recognized by the sense of smell and it would be surprising if they did not cause a great deal of trouble when absorbed into the system. Clinical evidence has of late been accumulated to prove that haematogenous absorption from oral lesions is frequently the obscure cause of systemic diseases. Toxemia due to such conditions impairs the patient's general health so that he is no longer able to do a full day's work, or is unable to withstand ordinary fatigue. If abscess conditions can be found in the mouths of these patients by means of Roentgen pictures, the removal of the lesions is usually followed promptly by a distinct improvement in the general health. Infectious arthritis and endocarditis are now generally believed to be due to a blood-carried infection and there are many cases of the more acute type of these diseases on record where the removal of the focus resulted in a prompt cure or a marked improvement.

Oral Lesions as Secondary Factors. In chronic disease, the hopeful therapeutic measure lies in improving the functional efficiency of the body and in improving the general health.[2] To further this achievement, it is important to remove all necrotic tissue, because the organs whose function it is to complete disease must be greatly taxed by their effort to eliminate the toxins and bacteria from such conditions when

[1] Cantani, Prof. Arnoldo. La Clinica Italiana. June and July, 1914.

[2] McCrudden, F. H. *The Treatment of Chronic Diseases is a Problem of Applied Physiology.* Boston Medical and Surgical Journal, Vol. clxxv, No. 2.

they might be using the energy thus expended to advantage in other places.

When removing foci in diseases such as chronic infections arthritis or subacute endocarditis we very frequently note a distinct improvement, which does not necessarily mean that the original focus or cause has been removed, but that the protective forces of the body have less to take care of and this results in a general improvement.

While a perfectly healthy body may take care of a certain amount of toxin, the same amount may produce serious results in a patient suffering from subacute endocarditis. The chart in Figure 310 shows the effect of an infectious process occurring in a patient with such a condition. The result of removing a focus is shown in the chart in Figure 311. The patient did not derive much benefit from the treatment he received from July to October, but upon removal of an abscessed tooth in October he gained in weight from 110 to 130 pounds in three months' time.

Referred Nervous Irritation. Reflex manifestations from one branch of the fifth nerve to another, or to communicating nerves, is quite a common occurrence, but often such pains are due to the most obscure causes. They may arise from an infectious lesion, causing inflammation of one of the branches of the maxillary or mandibular nerves, from pressure due to impacted and unerupted teeth, broken-off roots, ill-fitting fillings, crowns or bridges. Calcarious deposits in the dental pulp, commonly called pulp stones, are known to be another etiological factor. Sometimes after removing the pulp from a tooth there is continued pain due to an inflammatory condition or irritation of the small dental nerve, broken off at the apical foramen. The author has had several such cases which were relieved by apicoectomy. The pain may be referred to other organs, such as the eye and ear, or to various parts of the head and neck, and may be of varying degrees; that is, dull, slight and bearable, or excruciating. Attacks may come at irregular intervals and between them the patient may be free from pain or have only a dull aching. Impacted teeth may lie dormant for a long time and suddenly start exerting pressure, this process of rest and activity being repeated at irregular intervals.

Insomnia, neurasthenia, insanity and kindred nervous disorders may have impacted or abscessed teeth as an etiological factor. Many carefully observed cases are on record which have been cured by removing

a dental cause. Dr. Henry S. Upson in his book, "Insomnia and Nerve Strain," lays great stress on the importance of the teeth as an etiological factor of many mental disturbances.

Examination of the Oral Cavity by the Dentist. The acute forms of diseases have always been more or less feared on account of their violent symptoms. They are, as a rule, easily diagnosed and seldom neglected. The mouth, however, is more frequently the seat of chronic diseases which may exist for a long time without even giving local symptoms. The patient, having no discomfort in the diseased part, is usually unaware of the condition and as no special complaint is made, such chronic lesions sometimes develop under the very eyes of the general practitioner of dentistry. He, as a rule, spends little time in making a thorough examination of the mouth and adjacent parts, being too busy with his routine work and its many important and complicated details. It is just such symptomless lesions which so often cause obscure complications in neighboring parts and which are the foci of systemic infections. The Roentgenologist's examination reveals many unsuspected conditions in the mouths of patients who have had constant attention by conscientious dentists, and it is, therefore, to the interest of the general practitioner to improve his method of examination. Roentgenographic diagnosis is absolutely necessary to find out the condition of devitalized teeth or the presence of unerupted teeth and it is therefore important when examining a patient's mouth to use Roentgenograms as an adjunct in making a correct diagnosis. If the dentist has not a Roentgen machine of his own, he can easily secure pictures of the suspected teeth from a Roentgenologist, who will not only take the films, but will also give expert advice as to the interpretation of the pictures.

Examination of the Oral Cavity by the Physician. The physician often has occasion to inquire into the condition of his patient's mouth, especially when in search of a focus or foci of the disease concerning which the patient is consulting him. The mouth should not be overlooked by the diagnostician when making a thorough physical examination. Some physicians are contented with "The dentist is visited regularly," and "There is absolutely nothing wrong with the teeth," but the thorough diagnostician will not be satisfied except with a report based upon a careful examination and Roentgenographic diagnosis made by a dentist or specialist in whose judgment he can trust. Prospective mothers and patients

who expect to undergo serious operations should have their teeth carefully examined because the mouth, as the gateway to the digestive system, should be put in such condition that the carefully selected food will not be deteriorated by pus escaping from pyorrhea pockets and sinuses. Such examination will also assure them that their recovery will not be delayed nor complications invited by the presence of pus and bacteria, which may reach the intestinal tract with food and saliva or which may be aspired into the lungs while under the anesthetic. It is a well-known fact that subacute attacks of dormant, chronic, infectious lesions start when the body is at a low resistance, or when all the protective forces of the body are being used to build up during recovery. To prevent an active abscess or a toothache during such an important time is of great service to the patient and shows forethought and thoroughness on the part of the surgeon.

Charts Showing the Effect of Infection

Figures 310–311.

Figure 310 shows the chart of a patient with subacute endocarditis who had an infection the latter part of June, 1915. Note the long continued effect this had on the pulse rate. The same result occurred after the patient had scarlet fever. After four months the temperature was still 99.5 F. and the pulse rate was very high and irregular.

Figure 311 shows a chart of another patient with subacute endocarditis. The star marks the time when a tooth abscess was removed. This caused a quick rise in the weight curve.

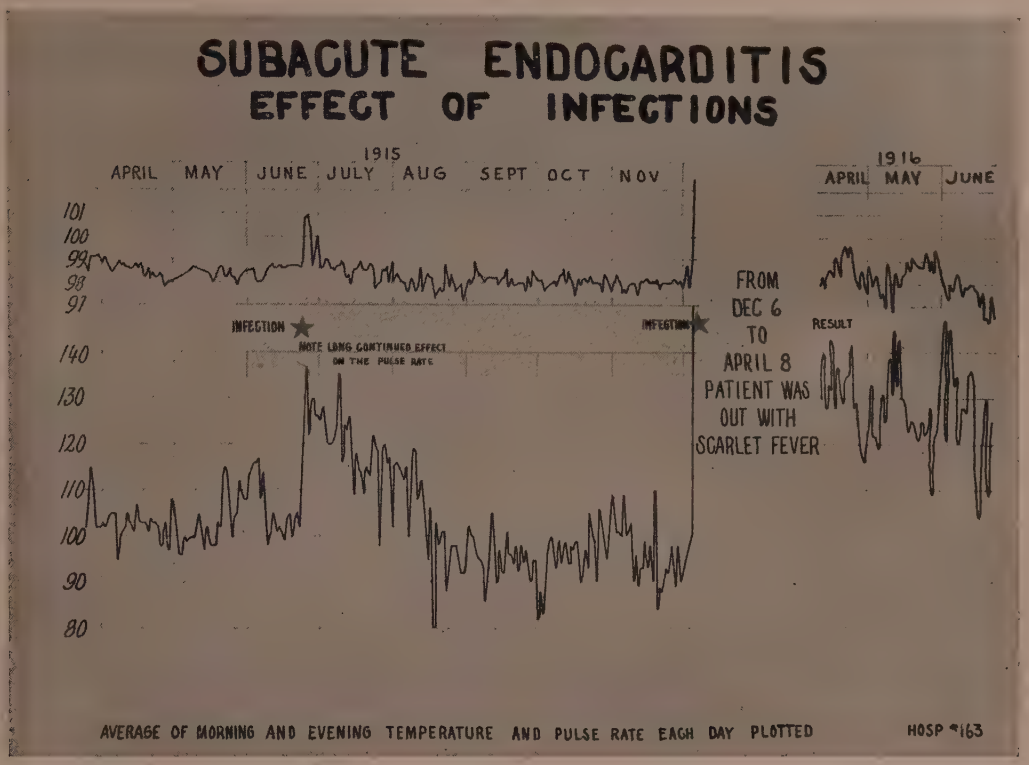

FIGURE 310.

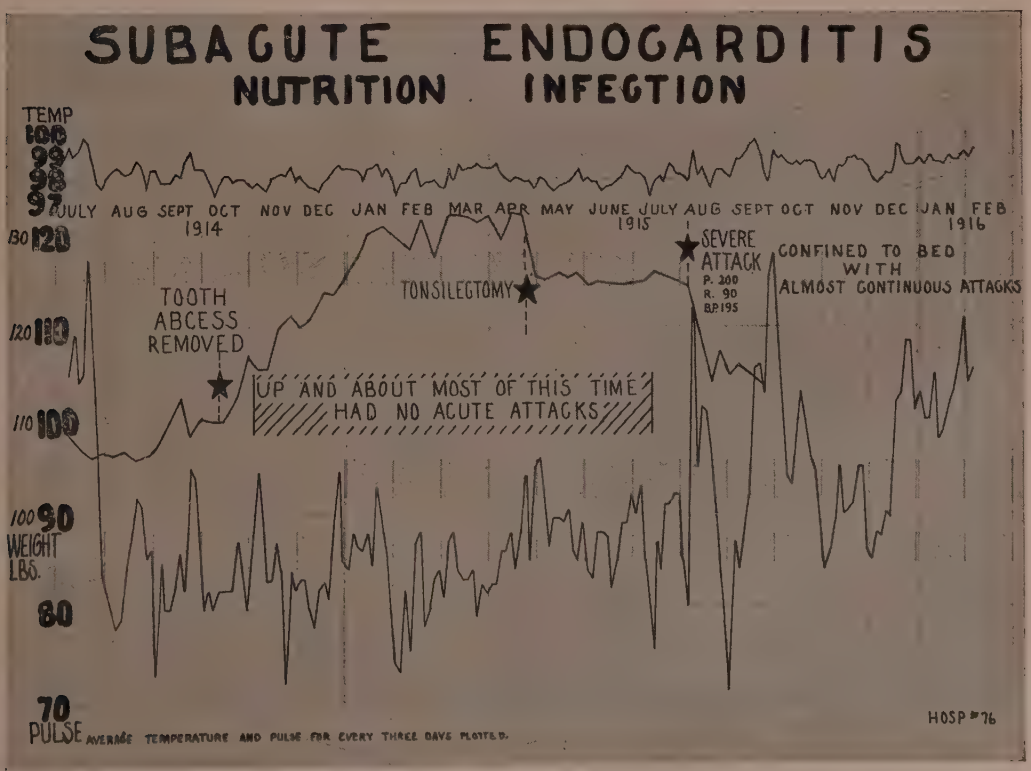

FIGURE 311.

INDEXES

INDEX OF CASE REPORTS

INDEX OF TEXT